

ABSTRACT

Title of Thesis: DEVELOPMENTAL MILESTONES,
CHILDHOOD BEHAVIOR AND
SCHIZOPHRENIA-SPECTRUM
SYMPTOMATOLOGY: AN INVESTIGATION
OF PSYCHOMETRICALLY IDENTIFIED
PUTATIVE SCHIZOTYPES

Courtney Brynn Forbes, Master of Arts, 2006

Directed By: Professor Jack J. Blanchard
Department of Psychology

The present study assessed retrospectively rated childhood abnormalities of development and behavior in individuals identified as having increased risk for schizophrenia using the psychometric high-risk paradigm. It was hypothesized that social anhedonics would have significantly more childhood behavior problems and developmental milestone delays than controls, and that anhedonics with greater childhood problems and developmental delays would display elevated levels of schizophrenia-spectrum symptoms. Examining proband reports, social anhedonics endorsed greater internalizing, thought, and total problems than controls. Analysis of mother reports revealed ratings of increased internalizing problems among social anhedonics. Mother ratings exhibited a trend toward significance for delayed walking in the social anhedonic group ($d=.59$). For social anhedonics, proband and mother rated childhood behavior problems correlated with clinician-rated schizophrenia-

spectrum symptoms, assessed at age 18. These findings indicate the presence of childhood behavior problems in social anhedonics and suggest an association between these early behavior problems and current clinical symptoms within the putative high-risk group.

DEVELOPMENTAL MILESTONES, CHILDHOOD BEHAVIOR AND
SCHIZOPHRENIA-SPECTRUM SYMPTOMATOLOGY: AN INVESTIGATION
OF PSYCHOMETRICALLY IDENTIFIED PUTATIVE SCHIZOTYPES

By

Courtney Brynn Forbes

Thesis submitted to the Faculty of the Graduate School of the
University of Maryland, College Park, in partial fulfillment
of the requirements for the degree of
Master of Arts
2006

Advisory Committee:
Professor Jack J. Blanchard, Chair
Assistant Professor Andrea M. Chronis
Assistant Professor Karen M. O'Brien

© Copyright by
Courtney Brynn Forbes
2006

Table of Contents

Table of Contents.....	ii
List of Tables.....	iv
Chapter 1: Introduction.....	1
Theories of Schizophrenia Development.....	1
Childhood Characteristics as Precursors or Indicators.....	5
Developmental Delays.....	7
Childhood Behavior: Retrospective Reports.....	9
Childhood Behavior: Genetic High-Risk Paradigm.....	11
Relationship Between Developmental Delays and Childhood Behavior.....	14
Assessment of Methodologies.....	16
Schizotaxia and Schizotypy.....	18
Social Anhedonia as a Predictor.....	21
Chapter 2: Study Rationale.....	24
Chapter 3: Study Overview.....	25
Participants.....	25
Baseline Measures and Procedures.....	27
Screening Questionnaire.....	27
Subject Recruitment Procedures.....	29
Assessments Completed by Probands.....	29
Debriefing Procedures.....	30
Parental Participation.....	31
Measures and Procedures.....	32
Report of Probands' Childhood Behavior.....	32
Report of Probands' Developmental Milestone Attainment.....	36
Procedure.....	36
Data Analyses.....	38
Convergence of Parent and Proband Report.....	39
Parent Ratings of Childhood Behavior.....	39
Proband Ratings of Childhood Behavior.....	40
Relationship Between Childhood Behavior Ratings and Schizophrenia- Spectrum Ratings.....	40
Developmental Milestones.....	41
Chapter 4: Results.....	42
Demographic Characteristics.....	42
Reliability of CBCL and YSR.....	44
Convergence of Parent and Proband Report.....	46
Parent Retrospective Ratings of Childhood Behavior.....	48

Proband Retrospective Ratings of Childhood Behavior.....	50
Correlations Between Childhood Behavior and Schizophrenia-Spectrum	
Ratings.....	53
Parent Ratings.....	53
Proband Ratings.....	56
Developmental Milestones.....	57
Chapter 5: Discussion.....	58
Appendices.....	67
Appendix A: Screening Questionnaire.....	67
Appendix B: International Personality Disorder Examination.....	71
Appendix C: CBCL/YSR Syndrome Scales.....	72
References.....	75

List of Tables

1. Demographics at Baseline by Group Status.....	27
2. Parental Participation at Baseline by Group Status.....	32
3. Demographic Characteristics of Recruited Mothers and Probands.....	43
4. Demographic Characteristics of Participating Mothers and Probands.....	44
5. Cronbach's Alpha, Scale Mean and Scale Standard Deviation for Subscales of the Parent Retrospective Report on the CBCL and Proband Retrospective Report on the YSR.....	45
6. Correlations Between Mother and Proband Ratings from the Child Behavior Checklist (CBCL) and the Youth Self-Report (YSR) Behavior Dimension Scores.....	47
7. Paired Sample T-tests Between Mother and Proband Reports by Age Period.....	47
8. Means and Standard Deviations of Mother Rated CBCL Subscales.....	50
9. Means and Standard Deviations of Proband Rated YSR Subscales.....	51
10. Correlations Between Mother Rated Behavioral Dimension Composite Scores and Schizophrenia-Spectrum Personality Disorder Dimensional Scores (Social Anhedonia Group)	55
11. Correlations Between Mother Rater Behavioral Dimension Composite Scores and Schizophrenia-Spectrum Personality Disorder Dimensional Scores, With Outlier Excluded (Social Anhedonia Group).....	56
12. Correlations Between Proband Rated Behavioral Dimension Composite Scores and Schizophrenia-Spectrum Personality Disorder Dimensional Scores (Social Anhedonia Group).....	57

Chapter 1: Introduction

Theories of Schizophrenia Development

Schizophrenia is a debilitating mental illness that afflicts approximately 1% of the general population (APA, 1994), and is characterized by an array of symptoms that, once present, often persist throughout one's lifetime. Genetic relatedness to an individual with schizophrenia is the best known indicator of increased risk for developing the disorder, with the level of risk rising sharply as degree of relatedness increases (Gottesman, 1991; Jablensky, 2000). Risk rises to 10% for first degree relatives of patients with schizophrenia, 10-15% for dizygotic co-twins (Jablensky, 2000), over 40% for the identical co-twins of those who develop schizophrenia (Cardno et al., 1999) and finally 48% for those with two parents with the disorder (Gottesman, 1991). Additionally, the genetic risk appears in the offspring of both affected and unaffected twins at very similar and elevated levels (Gottesman & Bertelsen, 1989). Adding to the validity of these genetic findings are study results indicating that the development of schizophrenia in adopted children is predicted by the positive diagnostic status of the biological parent rather than any characteristic of the adoptive family (Jablensky, 2000). While this combination of findings indicates that genetics are clearly implicated in the development of the disorder, it is apparent from the imperfect concordance rates that the outcome of schizophrenic illness is not solely determined by genetics. Adding further complication to the prediction of schizophrenia is that the pattern of concordance rates observed in families is not consistent with a model of single gene transmission, but rather points to a polygenic model involving several genes which each contribute a relatively small effect to the

overall vulnerability for schizophrenia development (Kendler & Diehl, 1993). Moreover, it is understood that the presence of a genetic liability for schizophrenia may not be sufficient for the development of the clinical disease, as these genes may remain unexpressed unless triggered by other factors such as the environment (Jablensky, 2000). As a result, the majority of people who carry the genetic vulnerability for schizophrenia never develop the disorder (Faraone & Tsuang, 1985).

The diathesis-stress model, which has been the dominant conceptual model in the field (Baum & Walker, 1995), provides an explanation for the observed diagnostic discordance between genetically identical individuals and accounts for potential environmental influence in diagnostic outcome. This model proposes that exposure to stress influences the behavioral expression of the biological vulnerability to schizophrenia. As a result, the knowledge of positive genetic liability alone may not reveal whether someone will in fact develop the disorder (Erlenmeyer-Kimling, Rock, Squires-Wheeler, Roberts, & Yang, 1991). The genetic factors in this model are specific to schizophrenia and therefore predict a specific risk, while the environmental factors are instead common to many disorders other than schizophrenia and are thus not considered “schizophrenogenic” (Fowles, 1992).

These risks include environmental factors such as maternal exposure to infection and postnatal environmental insults (Cornblatt & Obuchowski, 1997). It is this cumulative effect of various risk factors in combination with a genetic liability that results in the development of schizophrenia (McDonald & Murray, 2000).

More recent formulations of the diathesis-stress model emphasize the importance of neurodevelopment, and view schizophrenia as a developmental process

which may manifest itself long before the onset of overt psychosis (Hollister, Machon, & Mednick, 1995). Weinberger's (1987) conceptualization proposes that schizophrenia develops as a result of a static brain lesion, defined here as the general brain pathology, that occurs early in life and influences neurological functioning as it interacts with normal maturational events. Consequently, the effects of this lesion may not be apparent until a particular brain structure or system matures, resulting in the appearance of the actual clinical expression of the disorder to occur much later than its origination. Although this theory posits that the clinical manifestation of schizophrenia will not be expressed until later in life, Weinberger (1987) states that an assumption that the lesion will remain silent through adolescence is likely an oversimplification. Thus, it is reasonable to theorize that this putative abnormal neurodevelopment would manifest itself in childhood as forms of developmental deviance (Niemi, Suvisaari, Tuulio-Henriksson, & Lonnqvist, 2003). It is thought that the lesion may cause subtle disturbances or behavioral abnormalities, such as social awkwardness and shyness, previous to onset of the disorder (Cornblatt & Obuchowski, 1997; Weinberger, 1987).

Similar predictions would be made by Walker and Diforio's (1997) neural diathesis-stress model which assumes an organic diathesis that is typically congenital in nature. The expression of this diathesis is thought to be brought about by multiple interacting factors, and moderated by the maturation process of the central nervous system (Walker, Diforio, & Baum, 1999). The result is what Walker and colleagues refer to as a temporal disjunction between the onset of neuropathology and the clinical expression of schizophrenia (Walker et al., 1999). It is posited that the

diathesis results in a polymorphic behavioral expression that is exhibited in motoric, cognitive and socio-emotional domains and that the nature of the behavioral expression is determined by the interaction between the central nervous system and maturation. Just as critical periods in the development of the central nervous system are related to the acquisition of various cognitive and behavioral skills, this theory proposes that they may also coincide with critical periods for the detection of neuropathology throughout development (Walker, Diforio & Baum, 1999). For example, an investigation by Walker and colleagues concerning motor abnormalities demonstrated that group differences between preschizophrenic and control children were only significant during the first two years of life, during the time period in which motor skills develop (Walker, Savoie, & Davis, 1994). An additional hypothesis based upon this theory would be the presence of an intercorrelation between the potential deficits in various domains, if they are in fact manifestations of the same diathesis.

As indicated above, there are neither specific genetic or environmental indicators that predict the development of schizophrenia with great accuracy. Despite the substantial advancement in both the diagnosis and treatment of schizophrenia, much research is still needed to enhance the accurate identification of putatively psychosis-prone individuals. Although a positive family history for the disorder is the clearest indicator of increased risk (Niemi et al., 2003), identification on the basis of genetic risk nevertheless produces a substantial number of false positives. One way in which it may be possible to more accurately identify those at true-risk for schizophrenia is to identify deficits detectable prior to illness onset that serve as

markers or indicators of underlying biological vulnerability (Cornblatt, Obuchowski, Roberts, Pollack, & Erlenmeyer-Kimling, 1999). The framework of the neurodevelopmental model provides a strong basis for, and rational behind, studying childhood deviances in development and behavior as possible indicators as it assumes the presence of subtle early abnormalities. However, it is important to note that while both Weinberger's (1987) and Walker and Diforio's (1997) models would characterize these deviances as early manifestations of a later developing disorder, it is unclear as to whether these antecedents are to be considered specific precursors of later schizophrenic illness or risk factors that potentiate schizophrenia development (Hollis & Taylor, 1997). Beyond the potential for improvement of strategies for identifying those who may be at higher risk for developing schizophrenia, Hans (1992) states that the study of childhood antecedents to schizophrenia could also help clarify the etiology of the disorder and identify a possible subtype characterized by childhood deviance.

Childhood Characteristics as Precursors or Indicators

Consistent with the models proposed by Weinberger (1987) and Walker and Diforio (1997), an association between developmental and behavioral abnormalities in childhood and the later diagnosis of schizophrenia has been observed since the first clear descriptions of the disorder (Hollis & Taylor, 1997). Kraepelin (1919) viewed the abnormal premorbid personality exhibited by a number of those with schizophrenia as a precursor or early manifestation of the disorder. Similarly, Bleuler (1911) observed that the characteristics of seclusion and withdrawal tended to be prevalent in individuals who later developed schizophrenia. In line with these early observations,

it has been estimated that one-third (Jones, Murray, & Rodgers, 1995) to one-half (Rutter, 1984) of those diagnosed with schizophrenia have evidence of developmental deviance or non-psychotic abnormal behaviors in childhood. However, as yet there does not appear to be a clearly recognizable pattern of these premorbid abnormalities (Rutter, 1984). The deviances have been found to vary in both type and severity (Neumann, Grimes, Walker, & Baum, 1995; Rossi et al., 2000), with behavioral problems ranging from internalization to aggression, or mixture of both (Neumann et al., 1995). As Rossi (2000) notes, the heterogeneity observed in these childhood characteristics is unsurprising when considering the great variability in both the clinical symptoms and course of schizophrenia (Rossi et al., 2000).

Two important areas of study within the domain of childhood antecedents are the attainment of developmental milestones and characteristics of childhood behavior. Due to the low population base rate of schizophrenia it is advantageous to select a research methodology that increases the number of theoretically informative subjects in a given sample (Ingraham, Kugelmass, Frenkel, Nathan, & Mirsky, 1995). As a result, investigations of childhood precursors of schizophrenia generally fall into one of three methodological categories. These include retrospective studies which obtain retrospective information about the childhood of an individual already diagnosed with schizophrenia, birth cohort studies which analyze archived data collected about individuals often obtained for reasons not specific to this research question, and the genetic high-risk paradigm which typically prospectively studies children of mothers diagnosed with schizophrenia. Studies utilizing these various methodologies will be presented within sections devoted to research on two domains of childhood

antecedents to schizophrenia. Discussed first will be research regarding delays of motor and developmental milestones and their relationship to schizophrenic illness, followed by a review of studies investigating deviances in childhood behavior. Subsequently, studies assessing the relationship between observed developmental delays and childhood behavior abnormalities in those at risk to develop schizophrenia will be discussed.

Developmental Delays

Based upon observations of deviation in neurologic maturation of those with childhood-onset schizophrenia in a 1940s follow-up study, Barbara Fish proposed an inherited neurointegrative defect. She further suggested that the presence of this defect causes a susceptibility to a schizophrenia-like personality and predicts later schizophrenia development (Fish, Marcus, Hans, Auerbach, & Perdue, 1992). This neurointegrative disorder, called pandysmaturation (PDM), involves the retardation of motor and sensory-motor development which Fish conjectured is present within the first two years of life and could thus be used as an early marker for later schizophrenic illness (Fish, 1987; Fish et al., 1992). Fish began the New York Infant High Risk Project, the first formal genetic high risk investigation of children of mothers diagnosed with schizophrenia, and tested her PDM hypothesis. Results demonstrated that of the 12 high risk infants 7 were found to have PDM, compared to only 1 out of the 12 controls (Fish et al., 1992). Several studies of motor and neurological development in high risk populations have been conducted since (Niemi et al., 2003).

Results of a follow up to the 1946 National Survey of Health and Development birth cohort in Britain indicated the presence of milestone delays in

children later diagnosed with schizophrenia (Jones, Rodgers, Murray, & Marmot, 1994). When the children were two, mothers were asked to recall the ages in which their child attained the milestones of sitting, standing, walking, talking and cutting their first tooth. It was observed that those who later developed schizophrenia exhibited small delays on all milestones in comparison to controls, although only the ages of walking and talking reached significance. Additionally, there was a statistically significant excess of children in the pre-schizophrenic group that had not met all milestones at the age of two. Further analysis of this data set (Jones et al., 1995) examined the possibility that a sub-group of cases may have caused these differences. It was concluded that there was no evidence of a sub-group of abnormal cases that would account for the score differences, but rather that there may be a more widespread, yet smaller, effect among the pre-schizophrenic children.

Similarly, a 31-year follow up of the Northern Finland 1966 birth cohort assessed the early developmental milestones of individuals who later developed schizophrenia and other psychoses (Isohanni et al., 2001). At a 1-year examination, the age of milestone achievement was recorded for standing, walking, potty training, day/night time wetting and talking. Linear relationships between risk of schizophrenia and the milestones of learning to stand, walk and achieve potty training were observed with a “dose-response” effect. A statistically significant relationship was found between later standing and elevated risk of schizophrenia for boys, while a trend was observed in the same direction for girls. Later age of successful potty training was significantly related to schizophrenia risk for girls, and a non-significant trend was observed for boys. Similar results were revealed within the other

psychoses group, suggesting that there may be a lack of specificity of these developmental delays to schizophrenia, and that they may instead be related to psychosis more generally.

The Dunedin Multidisciplinary Health and Development Study obtained information regarding the age at which children in their birth cohort attained the milestones of smiling, sitting up, walking, potty training, feeding self and talking (Cannon et al., 2002). Results revealed a significant difference for age of walking between those that were later diagnosed with schizophreniform disorder and controls, but for no other milestones. Consistent with previous results, this difference resulted from later attainment by the schizophreniform group.

Childhood Behavior :Retrospective Reports

Reports by Neumann (1995) and Baum (1995) were based upon the retrospective assessment of childhood behavior problems for subjects diagnosed with schizophrenia and their healthy adult siblings for four age periods (0-4, 4-8, 8-12, 12-16) using a retrospective version of the Child Behavior Checklist (CBCL; Achenbach, Howell, Quay, & Conners, 1991). Results indicated that the preschizophrenic group exhibited more behavior problems than their siblings, and that for all behavior dimensions these differences increased with age. Reaching significance were the differences in the attention problems, social problems and thought problems dimensions. Interestingly, the observed differences for attention and thought problems were present in the first age group with the differences increasing with age, whereas the disparity between groups on the thought problems dimension was not apparent until the adolescent age group.

In an attempt to replicate of the above results, Walker and Baum (1998) investigated the relationship between the retrospective report of childhood behavior problems and schizotypal personality disorder in adolescents. When compared to a control group with no diagnoses, as well as a group of adolescents with non-schizophrenia spectrum personality disorders, the schizotypal group was rated as having more attention, social and thought problems (Walker & Baum, 1998). In line with the results of the Baum (1995) investigation, the differences between the schizotypal and control groups for the dimensions of attention and social problems appeared across all age periods whereas group differences for the thought problems dimension again did not emerge until adolescence. Beyond the replication of previous results, the similarity in outcomes between these two studies additionally adds evidence to the notion that schizotypal personality disorder marks an increased risk for the development of schizophrenia (Walker, Diforio & Baum, 1999).

Rossi and colleagues (2000) obtained similar results with a sample of patients with schizophrenia and their healthy siblings. Maternal ratings of childhood behavior problems were made for five age periods (0-3, 4-7, 8-11, 12-15, 16-18) for both siblings using a retrospective version of the CBCL. Results indicated a significant main effect between groups for each of the six behavior problem dimensions of the CBCL, with differences in behavioral abnormalities again increasing with age. Further, a cluster analysis revealed the presence of two clusters demonstrating differing patterns of behavior problems over time. One cluster exhibited slight early behavioral abnormalities that progressively increased with age, while the second cluster was characterized by more severe early abnormalities that remained relatively

stable over time. These results, in combination with those reported above, suggest that behavior problems may increase with age in those who later develop schizophrenia.

While research utilizing retrospective reports to ascertain information about the childhood of people with schizophrenia has been informative, this method suffers from a number of limitations. Perhaps most problematic is the fact that these retrospective reports of childhood behavior are made at a time when the adult diagnosis of schizophrenia is already known. Thus, it is possible that maternal ratings of the child's early behavior are biased by the knowledge of current psychological problems. Results from prospective studies, from which childhood behavior ratings are obtained prior to the onset of illness, may add to the validity of the findings obtained with the retrospective methodology.

Childhood Behavior: Genetic High-Risk Paradigm

An investigation conducted by Miller and colleagues utilized the Edinburgh High Risk Study sample to examine the relationship of childhood behavior with later schizophrenic illness (Miller, Byrne, Hodges, Lawrie, & Johnstone, 2002). This high risk sample was recruited based upon the presence of two close relatives affected with schizophrenia, given that the participant had not yet experienced psychiatric illness themselves. These subjects were matched with an age- and sex-balanced control group with no family history of schizophrenia, in addition to a group of matched individuals with first episode schizophrenia. Mothers of participants completed the Child Behavior Checklist (CBCL; Achenbach et al., 1991) at the time of recruitment for two age ranges, prior to 13 and between the ages of 13 and 16. For the high risk

subjects who developed schizophrenia within 39 months of recruitment (N=7), analyses of behavior ratings prior to age 13 revealed significant differences for both aggressiveness and total Achenbach scores when compared to both the rest of the high risk subjects who remained well and the control group. Overall differences were also obtained for the subscales of social withdrawal and social problems. Differences in ratings become more marked for the age range of 13 to 16, with the ill high risk individuals receiving significantly higher ratings than their non-ill high risk counterparts on social withdrawal, anxiety-depression, social problems, attention problems, delinquent behavior, aggressive behavior, other problems and on the total score. Further, these decompensate high risk subjects scored significantly higher than controls on these scales, with the exception of social withdrawal. Interestingly, the thought problems subscale did not differentiate the groups, and further, was not a useful predictor of later illness as may be expected given the nature of schizophrenia. It is possible, however, that maternal raters of symptoms would not be aware of such internal experiences. Overall, the results support the idea that early signs of schizophrenic illness are present previous to onset for those genetically identified as high risk, and further that these differences again appear to become more apparent with an increase in age.

Hans and colleagues (1992) reported on childhood related variables assessed in two longitudinal genetic high risk projects, the Israeli High-Risk Study (Nagler & Mirsky, 1985) and the Jerusalem Infant Development Study (Marcus, Auerbach, Wilkinson, & Burack, 1981). High risk subjects in these investigations were identified as such by the presence of one or two parents with a diagnosis of

schizophrenia. Comparison groups included children of parents with no history of mental illness for both projects, and an additional group of children of parents with non-schizophrenic mental illness in the Jerusalem study. Both studies provided data regarding the comparison of childhood interpersonal relations between offspring of schizophrenic and non-schizophrenic parents. Results indicated that the strongest discriminator between high risk and control subjects was ratings of social withdrawal and related behaviors, which appeared to primarily relate to male children. Further, the Jerusalem study provided evidence for the specificity of these findings to parental schizophrenic illness, as social withdrawal ratings of high risk children differed significantly from both children of parents with no mental illness and children of parents with other non-schizophrenic mental disorders. The results of this portion of the investigation failed to find any differences in aggression variables, which the authors note is contrary to a number of other prospective studies in this area. With a mean age of 10 at the time of assessment, this discrepancy may be due to the young age at which the ratings were obtained as acting-out behaviors may become more common in adolescence.

Analyses of the differences in childhood interpersonal behavior between high risk individuals who later received schizophrenia spectrum diagnoses and those who did not were examined using the Jerusalem sample. Results revealed that no child later diagnosed with a spectrum disorder (N=9) exhibited good early interpersonal adjustment, and further, that half of the individuals in this group were found to have exhibited extremely poor adjustment in the areas of social withdrawal, aggression or both. Those high risk individuals who displayed both extreme shy and aggressive

behaviors as children were determined to be at particularly high risk for developing schizophrenia spectrum disorders.

Similar results have been obtained in a number of genetic high-risk studies, as was succinctly reviewed by Niemi and colleagues (2003). Their review of 16 studies revealed consistent results pointing to increased problems in social adjustment in high risk children during school age and adolescent years. These problems included elevated levels of aggression, more disruptive or withdrawn behaviors, as well as problems with peer relations. The relative agreement that childhood behavior problems are present in those who develop schizophrenia and also increase with age between studies employing retrospective and prospective genetic high-risk designs adds to the validity of the results obtained by each design.

Relationship Between Developmental Delays and Childhood Behavior

The hypothesis based on the neural diathesis-stress model positing the intercorrelation of deficit domains due to their origination from the same diathesis was tested by Neumann and Walker (1996). Analyses revealed that early neuromotor abnormalities predicted later childhood behavior problems, and further, that the relationship was strongest for behavior problems in the adolescent age range (Neumann & Walker, 1996). These results lend support to the view that the same neural impairment may be responsible for the presence of these deficits (Walker, Diforio & Baum, 1999).

An investigation of the Swedish High-Risk Study reported on both developmental and behavioral characteristics of subjects (Henriksson & McNeil, 2004). The high-risk group (N=84), composed of offspring of women with a history

of psychosis recruited from prenatal clinics, was broken down into a group of offspring of women with schizophrenia (N=33) and a group of offspring of women with affective and other psychoses (N=26). The biological parents of the matched comparison group of controls (N=100) had no history of hospitalizations due to psychosis. Prospective information was obtained from Well-Baby Clinic records between the ages of 0 and 4 on eight characteristics: motor milestones, sensory difficulties, language skill disorders, medical treatment at other units, malformations, biological dysfunctions and disturbed behavior. Further, an accumulated risk score represented the number of deviations across these characteristics. Results indicated that the group specific to schizophrenia risk exhibited significantly more delayed walking, visual dysfunction, language skill disorders, enuresis, disturbed behavior and accumulated risk characteristics when compared with controls. The most frequently reported behavior problems were anxiety and poor social competence, sullenness and uncooperativeness, and withdrawal. The affective psychosis offspring, however, only evidenced significant delays in walking in comparison to controls suggesting a limited overlap in diathesis characteristics between the two at-risk groups. Further analyses of the total sample investigated the possible co-occurrence of multiple developmental delays within the same individual, as well as the co-occurrence of developmental delays and disturbed behavior. While results failed to find any overlap between the various developmental problems, a significant overlap between developmental problems and disturbed behavior emerged. Such results are consistent with the framework of the neurodevelopmental model of schizophrenia, which hypothesizes the presence of subtle abnormalities to occur prior to the onset of

illness. These results, like those from Neumann and Walker (1996), suggest that the observed motor or developmental abnormalities are associated with later childhood behavior problems and may, then, be the result of the same diathesis that leads to the development of schizophrenia.

Assessment of Methodologies

Each of the three methodologies utilized in research discussed above, including retrospective, cohort and genetic high-risk designs, have different limitations that constrain the generalizability of results. First, retrospective designs have the obvious limitation of being subject to recall bias and the possibility that subtle deviations from normality will not be remembered (Jones & Done, 1997). An additional issue is the psychological status of the subject at the time of retrospective reporting, as it is possible for the knowledge of a current psychological disorder to bias or distort memories of past functioning. While retrospective research has the capability to study the early life of those known to develop schizophrenia, the potential bias associated with the knowledge of psychological illness at the time retrospective ratings are made presents a substantial limitation.

Tarrant (1999) argues for the utility of the cohort design, stating that following large samples of the population identified by birth cohort provides unbiased prospective data of a representative group (Tarrant & Jones, 1999). While true, the design has a number of limitations. One of the most glaring is the sample size required to obtain enough cases to achieve adequate statistical power (Cornblatt & Obuchowski, 1997; Jones & Done, 1997). As the risk for schizophrenia in the general population is about 1%, a sample of 1000 randomly selected children will result in

only approximately 10 subjects who will one day develop schizophrenia (Cornblatt & Obuchowski, 1997). Additionally, the design requires that these large samples be followed closely through the entire risk period, which is quite costly (Cornblatt & Obuchowski, 1997). Further, the childhood data gathered for such large population samples is often not collected for the specific purpose of researching precursors to schizophrenia, resulting in rather crude data that is not well suited to this purpose (Hollis & Taylor, 1997; Jones & Done, 1997).

Cornblatt and Obuchowski (1997) argue that when considering the time and expense involved in prospective research, it is optimal to follow subjects who are thought to be at increased risk for schizophrenia rather than gathering such large population samples. Although individuals can be selected for high-risk investigations in a variety of manners, including biobehavioral and psychological assessments, the majority of the more than 20 high-risk studies conducted since the 1950s utilize those identified through a genetic high-risk paradigm. (Cornblatt & Obuchowski, 1997; Erlenmeyer-Kimling et al., 1991; Hollis & Taylor, 1997). While the genetic risk paradigm has undoubtedly been a useful methodology, Lenzenweger (1994) delineates important limitations of this design. It is estimated that 94% of those who develop schizophrenia do not have a parent diagnosed with the disorder (Gottesman, 1991) and 60% do not have a first- or second-degree relative with the disorder (Gottesman & Erlenmeyer-Kimling, 2001). These figures clearly indicate that most of those with schizophrenia have parents and/or relatives with an unexpressed and undetected liability. It is thus possible that genetic high-risk designs could be studying a highly familial form of schizophrenia that may not be generalizable to the

remainder of the schizophrenic population (Chapman et al., 1994; Niemi et al., 2003), which constitutes the vast majority of those who develop the disorder. Additionally, the genetic risk may not be “pure”, as women with schizophrenia have an increased likelihood of having children by men who are mentally abnormal, although not schizophrenic (Mednick & Hutchings, 1978). Beyond the stated issues directly related to genetics, the subject selection strategies in genetic high risk projects are inconsistent, and in some cases problematic with regards to generalizability (Tarrant & Jones, 1999). For example, inclusion criteria for the New York High-Risk Project required that the parents be white, speak English and be in an intact marriage with the other biological parent of the child in the study (Erlenmeyer-Kimling et al., 1991).

Lenzenweger (1994) proposed the use of the psychometric high-risk paradigm as a useful tool to utilize in addition to genetic risk methodologies to avoid the constraints of exclusive genetic selection of high-risk subjects. This paradigm allows for the identification of high-risk individuals to include those who may not have a positive family history of schizophrenia, but rather exhibit deviant psychometric characteristics believed to be associated with increased risk (Chapman et al., 1994; Lenzenweger, 1994).

Schizotaxia and Schizotypy

Schizotaxia, a concept proposed by Meehl, is defined as the heritable neural integrative defect affecting a latent class of individuals possessing the genetic liability for schizophrenia (Meehl, 1962). He conjectured that the presence of this genetic predisposition was necessary but not sufficient to develop schizophrenia or the related schizophrenia-spectrum disorders (paranoid, schizoid and schizotypal personality

disorders). According to Meehl (1962, 1990) the development of schizophrenia is dependent upon a complex interaction of schizotaxia, environmental social learning experiences and a set of polygenic heritable traits thought to potentiate the expression of schizophrenia. The personality organization that results from the interaction of these variables is what he called schizotypy, the phenotypic expression of the genotype, a term used by Rado (1956). Meehl originally postulated that there are four core traits of schizotypy that are universally held by those with schizotaxia: cognitive slippage, anhedonia, ambivalence and interpersonal adversiveness. While all schizotaxics are believed to become schizotypes through their learning experiences, Meehl's theory states that only 10% of schizotypes will actually decompensate to develop schizophrenia while the remainder will range from less extreme outcomes in the schizophrenia spectrum to generally normal functioning (Meehl, 1990). It is posited that those who decompensate do so due to the effects of polygenic potentiators such as anxiety and introversion, as well as other adverse developmental factors and adult stressors.

Following Meehl's hypothesis that those carrying the schizogene will show an underlying schizophrenia process even if they have not fully decompensated into schizophrenia, Loren and Jean Chapman developed paper-and-pencil true-false screening questionnaires designed to identify these putative schizotypes (Chapman et al., 1994). The Chapman Scales include the Physical Anhedonia Scale (Chapman, Chapman, & Raulin, 1976) which assesses sensory and aesthetic pleasure, the Perceptual Aberration Scale (PAS; Chapman, Chapman, & Raulin, 1978) which consists of items about distorted perceptual experiences, the Magical Ideation Scale

(MIS; (Eckblad & Chapman, 1983) which taps unusual beliefs of causation, the Impulsive Nonconformity Scale (Chapman et al., 1984) used to assess the failure to incorporate societal norms, and the Revised Social Anhedonia Scale (RSAS; Eckblad, Chapman, Chapman, & Mishlove, 1982) measuring schizoid indifference to people.

Chapman, Chapman, Kwapil, Eckblad and Zinser (1994) conducted a longitudinal study assessing these putative indicators of psychosis-proneness. Subjects were selected to participate based on deviant scores on the Physical Anhedonia (PhyAnh), Perceptual Aberration (PerAb), Magical Idea (MagicId) and Nonconformity (NonCon) scales. Social anhedonia scores were not used to select subjects, although they were collected at the baseline assessment. Results indicated that at 10-year follow-up the Chapman scales were not successful at predicting schizophrenia specifically. PhyAnh was not found to be useful in the prediction of either psychosis or psychosis-proneness. NonCon was found to only have a modest relationship with psychosis proneness. The scale was not found to predict psychosis at follow-up although group differences were found between the NonCon and control groups on other measures of psychosis-proneness such as deviant psychoticlike experiences as well as paranoid and schizotypal dimensional ratings at follow-up. High-scorers on the PerAb Scale, MagicId Scale, or both, were shown to have more psychosis, more psychotic-like experiences, higher schizotypal dimensional scores, and more psychotic relatives than control subjects at follow-up. It is important to note that while the PerAb and MagicID scales were found to be useful in the prediction of psychosis generally, they did not predict schizophrenia specifically. Interestingly, although social anhedonia was not used in the selection of subjects,

results indicated that the combination of MagicId with social anhedonia appeared to improve the prediction of psychosis proneness beyond the use of MagicId alone, and resulted in a high rate of clinical psychosis (21%). The addition of social anhedonia to the PerAb scale did not further improve prediction. The finding that those with high scores on both the MagicId scale and social anhedonia scale are especially psychosis prone, suggests both the potential utility of using a syndrome of traits as predictors as well as the utility of further study of anhedonia as a predictor.

Social Anhedonia as a Predictor

In Meehl's original formulation of schizotaxia and schizotypy the trait of anhedonia was considered "one of the most consistent and dramatic behavioral signs of the disease (Meehl, 1962, p. 829)". Meehl described anhedonia as being primarily interpersonal in nature and experienced by all schizophrenia-prone individuals. More recently Meehl (1990) relegated anhedonia to a less central role in his theory, downgrading it from a core symptom of schizotypy to one of the polygenic factors that may potentiate the risk of schizophrenia development. Even with this shift in Meehl's theory, research suggests that social anhedonia is a promising predictor of increased schizophrenia proneness and continues to be investigated it as a putative indicator of schizotypy (Blanchard, Gangestad, Brown, & Horan, 2000; Kwapil, 1998).

Kwapil (1998) investigated the usefulness of social anhedonia as a predictor of schizophrenia-spectrum disorder development in a re-analysis of the 10-year follow-up data collected as a part of the longitudinal study conducted by Chapman and colleagues (1994). The data indicated that those college students identified by

high scores on the social anhedonia scale did not differ from controls in rates of schizophrenia-spectrum disorders at baseline in late adolescence or early adulthood. However, they did differ significantly 10 years later with 24% of the social anhedonic group meeting criteria for spectrum disorders in comparison with only 1% of controls. Moreover, the ability of social anhedonia to predict spectrum-disorders was not improved by the inclusion of other psychosis-proneness scales or symptom ratings from the baseline assessment. Further, social anhedonics were not found to have increased risk for mood disorders at 10-year follow-up suggesting that the anhedonia scale is indeed related to schizoid withdrawal rather than mood syndromes.

However, within the existing research on social anhedonia, there has been a reliance on nonrepresentative, predominately white, college student samples such as those utilized in the Chapman study (Chapman et al., 1994; Kwapil, 1998). This is particularly problematic when considering that less than 28% of the general population goes on to obtain a college education (US Census Bureau, 1998), and further that those who do attend college are significantly less likely to develop psychiatric disorders than those who do not (Newman, Moffitt, Caspi, & Silva, 1998; Robins et al., 1984). These statistics put the generalizability of previous research results regarding the predictive ability social anhedonia in question, and highlight the need to conduct this research with a representative community sample.

Although social anhedonia has proven to be the most useful indicator of schizophrenia-spectrum liability out of the personality measures studied, it is still an imperfect predictor of later decompensation. While social anhedonic individuals show significantly elevated rates of schizophrenia-spectrum symptomatology than controls,

as was demonstrated by Kwapil (1998), the vast majority of social anhedonics do not go on to develop these disorders. Although this imperfection in prediction does not come as a surprise given the vast heterogeneity observed in both the onset and course of schizophrenia, missing from the current literature is an examination of factors that may account for the variability in outcomes of social anhedonics. Identification of these factors would lead to more accurate prediction of later psychopathology within those identified as putative schizotypes.

Chapter 2: Study Rationale

The current study sought to investigate childhood developmental and behavioral factors in the development of schizophrenia and related schizophrenia-spectrum disorders within a community sample of psychometrically identified individuals conjectured to have increased schizophrenia liability. This investigation had two objectives: 1) It was the first study to assess reports of childhood deviances of those considered to be at a higher genetic risk for schizophrenia using a psychometric high-risk paradigm, with the potential to extend previous childhood developmental and behavioral research to an additional and possibly more generalizable identification methodology, and 2) It assessed the relationship of reports of childhood factors with of schizophrenia-spectrum symptomatology in identified social anhedonics, leading to a greater understanding of social anhedonia, possible factors that may help explain the heterogeneity outcomes of social anhedonics, and adding to the validity of social anhedonia as a putative indicator of increased risk.

It was hypothesized that social anhedonics would have significantly higher ratings of childhood behavior problems and developmental milestone delays than controls, consistent with previous research utilizing other risk-paradigms. It was further hypothesized that those social anhedonics with greater ratings of childhood behavior problems and developmental milestone delays would display increased levels of schizophrenia-spectrum symptomatology when compared to those who do not exhibit these childhood deviances.

Chapter 3: Study Overview

Participants

The present study utilized a representative community sample recruited as a part of the larger Maryland Longitudinal Study of Schizotypy (MLSS). Over 3,508 18- to 19 year olds living the within a 15-mile radius of the University of Maryland College Park (UMCP) campus were identified through the random-digit-dial method by the UMCP Survey Research Center. Of this group, 2,434 (69%) completed and returned a screening questionnaire including the Revised Social Anhedonia Scale (RSAS; Eckblad et al., 1982), the Perceptual Aberration scale (PerAb; (Chapman et al., 1978) and the Magical Ideation scale (MagicID; Eckblad & Chapman, 1983). In addition, items of the Infrequency Scale (Chapman et al., 1976) where intermixed within the questionnaires to identify invalid responding. Consistent with previous research (Chapman et al., 1976), individuals who endorsed three or more items in the unexpected direction where excluded from the study. (See Appendix A for measures) Participants were paid \$15 upon the completion and return of the screening questionnaire and signed consent form.

Recruited individuals were identified by extreme scores on the RSAS through two different selection methodologies. Of the 86 study participants identified by elevated social anhedonia scores, 72 (83.7%) where selected on the basis of RSAS scores falling at least 1.9 standard deviations above the mean. This method of subject selection is consistent with previous research (Chapman et al., 1994; Kwapil, 1998). As prior research (Chmielewski, Fernandes, Yee, & Miller, 1995; Kelley & Coursey, 1992) suggests the presence of significant racial and gender group differences on the

RSAS, the present study determined standard deviation cut-offs separately for each racial group and gender. The second method of selection involved using the taxometric method of maximum covariate analysis (MAXCOV-HITMAX; Waller & Meehl, 1998). Individuals with Bayesian probabilities greater than or equal to 0.50 were assigned to the social anhedonia taxon group (e.g., Blanchard et al., 2000; Horan, Blanchard, Gangestad, & Kwapil, 2004). This method identified 14 (16.3%) additional social anhedonics not already identified by the standard deviation cut-off.

Individuals in the control group (N=89) did not have elevated scores on the RSAS (i.e., scores less than 0.5 standard deviations above the mean and Bayesian probabilities of being in the social anhedonia taxon below 0.50). Additionally, members of the control group did not score higher than 0.50 standard deviations above the mean on either the PerAb or MagicId scales of psychosis proneness. Previous research indicates that Caucasians tend to score lower than minority groups and men tend to score higher than women on the social anhedonia scale (Chmielewski et al., 1995; Kelley & Coursey, 1992). Thus, efforts were made to match control participants with members of the social anhedonia group on gender and race. No significant differences were found between the two groups for gender ($\chi^2(1, N=175) = 0.164, p>.05$) or race ($\chi^2(4, N=175) = 1.527, p>.05$). (see Table 1 for demographics)

Table 1.

Demographics at Baseline by Group Status

	Social Anhedonia (N=86)	Control (N=89)
Gender		
Male	49 (57%)	48 (54%)
Female	37 (43%)	41 (46%)
Ethnicity		
Caucasian	38 (44%)	40 (45%)
Black	40 (47%)	37 (42%)
Hispanic	6 (7%)	7 (8%)
Asian	1 (1%)	2 (2%)
Other	1 (1%)	3 (3%)

Baseline Measures and Procedures

Screening Questionnaire

Revised Social Anhedonia Scale: The Revised Social Anhedonia Scale

(RSAS; Eckblad et al., 1982) was used to identify social anhedonics and controls. The RSAS is a 40 item True/False self-report measure designed to assess decreased pleasure derived from interpersonal sources (Blanchard et al., 2000). Validation of the RSAS as a measure of social anhedonia comes from findings that high scores on the RSAS are related to interview-based reports of current social withdrawal and isolation (but not loneliness), and reports of less enjoyment from and need for social contact (Mishlove & Chapman, 1985). Example items include “If given the choice, I would much rather be with others than be alone” (keyed false) and “Although I know I should have affection for certain people, I don't really feel it” (keyed true). The RSAS has high test-retest reliability (Blanchard, Mueser, & Bellack, 1998), and has been shown to be internally consistent (Blanchard et al., 1998; Mishlove & Chapman, 1985).

Perceptual Aberration Scale: The Perceptual Aberration Scale (PerAb; Chapman et al., 1978) is a 35-item scale developed to assess disturbances and distortions in perception of the body and other objects. Example items include, “I have never felt that my arms or legs have momentarily grown in size” (keyed false) and “Occasionally I have felt as though my body did not exist” (keyed true). The PerAb scale has been found to have adequate internal consistency, with alphas around 0.90, as well as high test-retest stability ($r=0.75$; Chapman & Chapman, 1985).

Magical Ideation Scale: The Magical Ideation Scale (MagicId; Eckblad & Chapman, 1983) is a 30-item scale that measures unusual beliefs of causation that are considered as invalid or magical by conventional standards. Example items include “Good luck charms don’t work” (keyed false) and “Some people can make me aware of them just by thinking about me” (keyed true). Coefficient alphas were found to be .82 for males and .85 for females (Eckblad & Chapman, 1983).

Infrequency Scale: The Infrequency Scale (Chapman & Chapman, 1976) is a 17-item scale developed to identify invalid responding. The scale includes items that nearly everyone would answer in a universal direction, such as “I visited Easter Island last year.” In line with previous research (e.g., Chapman et al., 1994; Kwapil, 1998), participants who responded to 3 or more items in the unexpected direction were excluded from the study as it suggests invalid responding throughout the screening measures.

Demographic and Contact Information: At the time of initial screening, participants were asked to provide information regarding gender, ethnicity, socioeconomic status, education level, phone number and mailing address.

Subject Recruitment Procedures

Based upon subject selection criteria and methods explained above, potential subjects were contacted via phone, letter or email and given the opportunity to participate in the study. They were informed of the tasks involved in the study, that completion of these tasks would take between three and five hours, and that they would be compensated \$100 for their participation. Of the 392 people contacted, 213 (54%) agree to participate. Those who agreed to schedule an appointment were asked not to use drugs or alcohol for the 24 hours prior to their appointment time. Upon arrival to the lab, subjects were asked to review and sign a consent form explaining the tasks included in the study, the risks involved, as well as phone numbers for reaching the study staff and principal investigator should they have additional questions or concerns. Participants were informed that the interview would be videotaped by an unconcealed camera for the purposes of supervision.

Assessments Completed by Probands

Participants completed diagnostic interviews, symptom ratings, family ratings, and a number of cognitive and neuropsychological measures. The present study will utilize information from one of these assessments, the International Personality Disorder Examination (IPDE; Loranger, 1995).

International Personality Disorder Examination: Subjects were interviewed with the International Personality Disorder Examination (IPDE; Loranger, 1995) to obtain dimensional scores for schizotypal, schizoid and paranoid personality disorders. The IPDE has demonstrated adequate interrater reliability with kappas of 0.57 for the DSM-III-R and 0.65 for the ICD-10 (Loranger et al., 1994). The IPDE

has been utilized in a number of studies regarding schizophrenia-spectrum disorders in putatively psychosis-prone subjects (e.g., Blanchard & Brown, 1999; Brown, Blanchard, & Horan, 1998; Chapman et al., 1994). Diagnostic interviews were done blind to group status and under the supervision of a licensed clinical psychologist (Dr. Blanchard). (See Appendix B for measure)

Debriefing Procedures

Upon completion of the study tasks, participants were informed of the general nature of the study and given an opportunity to ask questions or raise concerns regarding their participation. Due to the unclear relationship between social anhedonia and the development of schizophrenia or other psychotic disorders, participants with elevated social anhedonia scores were not informed that they may be at risk for such problems. Diagnoses determined throughout the course of assessment were discussed with the participant, and informational brochures were made available through the National Institute of Mental Health (these brochures covered depression, bipolar disorder, and schizophrenia), the National Institute on Drug Abuse (on substance disorders), and the National Institute on Alcohol Abuse and Alcoholism (on substance disorders). If the participant was not in treatment for the diagnosed disorder(s), treatment referrals, including names, phone numbers, and addresses of clinics and treatment providers were provided. Those participants diagnosed with a psychotic disorder who were not currently in treatment also received a follow-up phone call from the experimenter to determine if additional information or assistance was required. Participants were asked to provide phone numbers and mailing

addresses for their biological parents, who were later contacted to participate in the study.

Parental Participation

Approximately one year following the initial assessment with the proband the biological parents of probands were contacted and invited to participate in the study. They were informed of the tasks involved in the study, that completion of these tasks would take between three and five hours, and that they would be compensated \$100 for their participation. Parents were asked to complete the same battery of assessments as their child, which included diagnostic interviews, symptom ratings, family ratings, as well as cognitive and neuropsychological measures. However, if the parent was unable or unwilling to travel to UMCP to complete the assessment the option of a phone interview was given, in which case the cognitive and neuropsychological measures were not completed.

A total of 107 probands (61%) had at least one parent participate in the study, with 54% of mothers and 31% of fathers participating. Approximately 25% of the sample had both parents participate. Chi-square analyses revealed no significant differences in parental participation between the social anhedonic and control groups ($\chi^2(2, N=175) = 1.12, p > .05$). (see Table 2) These figures indicate that more than half of the subject group had at least one parent willing to participate in the lengthy laboratory study, lending support to the idea that parents will be willing to participate in additional less-intensive investigations such as the one proposed here.

Table 2.

Parental Participation at Baseline by Group Status

	Social Anhedonia (N=86)	Control (N=89)
Mom Participated	50 (58%)	46 (52%)
Dad Participated	29 (34%)	26 (29%)
At Least One Parent Part.	56 (65%)	51 (57%)
Both Parents Participated	23 (27%)	21 (24%)

Measures and Procedures

Report of Probands' Childhood Behavior

To supplement the data already collected regarding the present functioning of the participating probands, the current study collected data regarding childhood and adolescence. Ratings of childhood behavior were obtained from two sources, a parent and the proband, using two instruments from the Achenbach System of Empirically Based Assessment (ASEBA; Achenbach & Rescorla, 2001). ASEBA instruments have been used in over 4,000 published studies (Berube & Achenbach, 2002). The current study utilized retrospective versions of the Child Behavior Checklist (CBCL; Achenbach et al., 1991) and the Youth Self-Report (YSR; Achenbach, Howell, McConaughy, & Stanger, 1995).

Child Behavior Checklist: Parental ratings of probands' childhood behavior problems were assessed using a version of the Child Behavior Checklist (CBCL; Achenbach et al., 1991). The CBCL is considered the most widely used rating scale measure of child symptomatology (Lengua, Sadowski, Friedrich, & Fisher, 2001). This measure gathers information on a variety of child behavior problems and provides scores for seven empirically derived behavioral dimensions: social-

withdrawal, anxious-depressed, somatic complaints, social problems, attention problems, delinquent and aggressive behavior, and thought problems (see Appendix C for subscale items). These dimensions may also be combined to create overall internalizing, externalizing and total problems scores. Each item is scored on a 3-point scale ranging from 0 (not true) to 2 (very true). The CBCL has been found to have good reliability. An investigation of parent reports of normal and disturbed children found that interclass correlations for interparental agreement, 1-week test-retest reliability and interinterviewer reliability were each .90 or greater (Achenbach & Edelbrock, 1981).

For use in this study, the 124 items of the CBCL were changed to past tense due to the retrospective nature of the investigation. This modification of the measure was initially completed by Baum and Walker (1995), as there was no established measure for retrospective ratings of specific childhood behaviors. This retrospective version of the CBCL has since been used in additional investigations of child development and schizophrenia (Miller et al., 2002; Neumann et al., 1995; Rossi et al., 2000; Rossi et al., 2002), and was utilized in the present study. Unfortunately, these publications do not report on the psychometrics of this revised version. There are valid concerns regarding the accuracy of retrospective recall (Henry, Moffitt, Caspi, Langley, & Silva, 1994; Rutter, 1998), and it has been suggested that use should be limited to testing hypotheses about the relative standing of individuals in a distribution (Henry et al., 1994) as will be done in the present study. Additionally, the relative agreement observed between results based upon the retrospective version of the CBCL (Miller et al., 2002; Neumann et al., 1995; Rossi et al., 2000) and those

results obtained by prospective methods (Niemi et al., 2003) in research of childhood antecedents of schizophrenia is encouraging, and adds to the validity of the results obtained by this form of the measure. Similar to these previous investigations, the parent was asked to rate their child for three time periods: birth-5 years, 6-12 years, 13-18 years. (See Appendix D for measure) These age periods correspond with the developmental periods of preschool, early and middle childhood, and adolescence (e.g. Brocki & Bohlin, 2004).

Research indicates that agreement between child and parent ratings of a child's emotional and behavioral problems is low to moderate, with correlations averaging 0.25 (Achenbach, McConaughy, & Howell, 1987). An investigation conducted by (Achenbach, Dumenci, & Rescorla, 2003) found a correlation of $r=.38$ between the total scores of the Youth Self Report (YSR; Achenbach et al., 1995) of 11 to 18 year olds and parent report on the Child Behavior Checklist (CBCL; Achenbach et al., 1991). Additionally, results revealed that scores on the YSR were significantly higher than the CBCL, indicating that children reported experiencing significantly more problems than reported by their parents.

Similar results were obtained by Sourander and colleagues (1999) in an investigation utilizing the YSR with 15- to 16- year-olds and the parent-rated CBCL (Sourander, Helstela, & Helenius, 1999). Correlations between the two measures ranged from 0.17 for the thought problems scale to 0.68 for the competence scale, with the correlation between the total scores of the YSR and CBCL being 0.45. Again, children reported significantly more problems than parents as well as a lower competence score. Further analyses revealed a significant interaction between

informant and sex in which the discrepancies between parent and youth self-report were greater for girls, especially for the internalizing scales. Additionally, it has been reported that while children themselves are often the best informant of their internal states (Loeber & Farrington, 1994), most children are not good informants on their own attention problems, hyperactivity and oppositional behaviors (Loeber, Green, & Lahey, 1990; Loeber, Green, Lahey, & Stouthamer-Loeber, 1991).

The combination of the above results revealing low to moderate correlations between youth and parental reports of behavior problems, as well as evidence of statistically significant discrepancies between informants, highlights the importance of obtaining information from both sources as suggested by numerous investigators (Loeber & Farrington, 1994; Sourander et al., 1999; Youngstrom, Loeber, & Stouthamer-Loeber, 2000). Based upon these results, the present study collected information from both the parent and proband.

Youth Self Report form: The Youth Self Report form of the CBCL (YSR; Achenbach et al., 1991) is a 118-item measure that is derived from the parent-reported CBCL. The YSR and the CBCL have identical item content for the majority of items, with the YSR including additional items regarding positive behaviors. As with the CBCL, the YSR provides data on seven empirically derived behavior problem dimensions, as well as internalizing, externalizing, and total score. One-week test-retest reliability coefficients are 0.80 for internalizing problems and 0.81 for externalizing problems (Achenbach et al., 1991). For this study, the YSR was reworded to reflect the retrospective nature of the investigation. Presently, there is no data available regarding the reliability or validity of the YSR when modified in this

way. Probands were asked to fill out the retrospective YSR for two time periods, between the ages 6-12 and 13-18. (See Appendix E for measure)

Report of Probands' Developmental Milestone Attainment

The parent was asked to report on a number of their child's developmental milestones including: sitting, crawling, standing, walking, teething and talking. Ages at milestone attainment was reported utilizing the categories of early, on time, and late, as was done previously by Cowen and colleagues (Cowen, Work, Wyman & Jarrell, 1994). In an attempt to obtain the most accurate estimate, parents were asked to use information found in their child's baby book or other records if available (See Appendix F for measure). There is currently no data available regarding the reliability or validity of such retrospective reporting of developmental milestones. As such, results obtained from this measure were interpreted with caution.

Procedure

For the present study, parents and probands were contacted by mail to participate. Probands received a packet including the modified retrospective YSR measure to be completed for two age ranges, and the parents were asked to fill out a packet of questionnaires containing the modified retrospective CBCL measure to be filled out for the three proband age ranges as well as questions concerning the age of attainment of the six developmental milestones. In this study the proband's mother was the primary parent asked to report on the childhood behavior problems and developmental milestones, which is consistent with previous research in this area (Baum & Walker, 1995; Neumann et al., 1995; Rossi et al., 2000). The principal reasons for this decision are that mothers tend to be the primary caretakers, the

documented difficulty in obtaining father participation in research (Hops & Seeley, 1992), and that the baseline parental participation rates indicate increased participation of mothers versus fathers in this sample (54% vs. 31%). Mothers were asked to indicate whether they were the primary caretaker of the child and provide information regarding the child's living situation during the time periods in question. If it was indicated that the child was primarily in the care of the father or other person, a questionnaire packet would have then be sent to that person as well with the goal of collecting the most accurate information on the child. However, this procedure was not necessary, as all returned questionnaires indicated that the mother served as the primary caregiver of the proband.

Mailings included an information letter explaining the study, describing what their participation would entail and informing them that they would be paid \$25 for their participation. This letter included contact information for the lab if they had any questions and had a return date deadline indicated. The packet contained two consent forms, one to be signed and returned should they wish to participate, and a second copy for their records. Included in the mailing was the set of questionnaires including a copy the retrospective CBCL for the parent or the retrospective YSR for the proband, as well as the developmental milestone survey for the parent. Each questionnaire had a set of detailed instructions regarding the scales used to score the items as well as the time period to be considered for the measure. Also included was a form to collect the necessary information needed to request and send the parent or proband a check for their participation after the return of the completed questionnaires. And finally, there was a postage-paid envelope to return the forms.

This envelope had a checklist on it reminding the participant of the components that should to be sent back (i.e. a *signed* consent form).

Approximately three weeks were allotted for the return of questionnaires before reminders were given. At this time a reminder letter was sent, again with information to contact the lab if they had any questions or wanted to have the packet sent out to them again. Five weeks after the initial mailing (2 weeks after the reminder letter) an additional letter was sent to those parents and probands who did not yet return questionnaires. Eight weeks after the initial mailing phone calls were made to those parents and probands who had not returned questionnaires to determine their participation status.

Data Analyses

Initial analyses were conducted to compare parents and probands who returned completed questionnaires with those who did not. Chi-square analyses were performed separately by informant, and test for the presence of significant differences on the demographic variables of age, sex, ethnicity and group status of the proband (social anhedonic vs. control). Further chi-square analyses were conducted between the social anhedonic and control groups for those that had returned and completed questionnaires. Again, these analyses were performed separately by informant, and test for the presence of significant differences on the demographic variables of age, sex and ethnicity.

Reliability statistics were completed for the retrospective CBCL measure using Chronbach's alpha to determine the internal consistency of the scale, assessed separately by informant.

Convergence of Parent and Proband Report

Convergence of parent and proband reports of childhood behavior on the retrospective CBCL were assessed. Two summary scores were computed to decrease the number of comparisons from eight to six. The withdrawn, anxious-depressed and somatic complaints subscales were combined into an internalizing summary score and the aggression and delinquency subscales were combined into an externalizing summary score, consistent with analyses in previous reports (St. Hilaire et al., 2005). Correlations between the parent and proband ratings on the CBCL and YSR were conducted for the ratings of internalizing, externalizing, attention, social problems, thought problems and the total score for ratings at Time 2 and Time 3.

Additionally, paired-sample t-tests analyses were conducted separately for Time 2 and Time 3 for each CBCL and YSR dimensions (internalizing, externalizing, attention, social problems, thought problems, total score). These analyses investigated differences in ratings between informants.

Parent Ratings of Childhood Behavior

To test the hypothesis that the social anhedonic group would exhibit increased parent rated childhood behavior problems compared to controls, as well as assess for the presence of increasing behavior problems with age, a repeated-measures analysis of variance (ANOVA) was conducted. For this analysis, proband group status (social anhedonic vs. control) was the between subjects factor and age (0-5, 6-12, 13-18) and parent rated CBCL dimensions (internalizing, externalizing, social problems, thought problems, attention problems, total problems) were within-subjects factors. These

analyses investigated the main effect of group status, main effect of age and a group by age interaction for parent rated childhood behavior.

Proband Ratings of Childhood Behavior

To test the hypothesis that the social anhedonic group would exhibit increased proband rated childhood behavior problems compared to controls, as well as assess for the presence of increasing behavior problems with age, a repeated-measures analysis of variance (ANOVA) was conducted. For this analysis, proband group status (social anhedonic vs. control) was the between subjects factor and age (6-12, 13-18) and proband rated YSR dimensions (internalizing, externalizing, social problems, thought problems, attention problems, total problems) were the within-subjects factors. These analyses investigated the main effect of group status, main effect of age and a group by age interaction for proband rated childhood behavior.

Relationship Between Childhood Behavior Ratings and Schizophrenia-Spectrum Ratings

The hypothesis that childhood behavior would be related to schizophrenia-spectrum disorder dimensional ratings from the IPDE was assessed using correlational analyses. These analyses were conducted separately for the control and social anhedonic groups, and examined the correlations between the six CBCL and YSR behavioral dimensions (internalizing, externalizing, social problems, attention problems, thought problems, total score) and the schizophrenia-spectrum dimensional scores (schizotypal, schizoid and paranoid). In an attempt decrease the number of correlations computed, and reduce family-wise error, the dimensions of the retrospective CBCL were correlated across time periods for each informant to determine the appropriateness of creating a composite score across the age ranges.

Composite scores were then used in correlations with the schizophrenia-spectrum dimensional scores.

Developmental Milestones

Univariate ANOVA analyses were used to assess group differences for each of the six developmental milestones (sitting, crawling, standing, walking, teething, talking). The age at each milestone attainment was then correlated with the three schizophrenia-spectrum dimensional scores (schizoid, schizotypal, paranoid).

Chapter 4: Results

The present study sought to investigate the relationship between childhood abnormalities of behavior and development in individuals identified psychometrically as high risk. Childhood behavior problems were assessed by both mother and proband, utilizing retrospective versions of the CBCL and YSR, respectively. Additionally, mother reports of developmental milestone attainment were utilized. First, initial analyses include the examination of group differences both between those who did and did not participate in the current study, as well as between social anhedonic and control groups obtained for the final study sample. Second, the reliability of the CBCL and YSR subscales were evaluated. Third, convergence of parent and proband reports of childhood behaviors on the retrospective CBCL and YSR dimensions were assessed. Fourth, group differences between social anhedonic and control groups were examined for each of the behavioral dimensions of the CBCL and YSR. Fifth, the correlations between childhood behavior and schizophrenia-spectrum dimensional ratings were evaluated. And finally, group differences for each of the developmental milestones were examined.

Demographic Characteristics

In order to investigate potential biases in recruitment, chi-square analyses examining differences on demographic variables (i.e. sex, ethnicity, and proband group status) between participants and non-participants were performed separately by proband and parent informant. Results indicated the presence of a significant difference between probands that did and did not return questionnaires for the

variable of sex ($\chi^2(1, N = 175) = 5.00, p < .05$), with fewer males than females returning questionnaires (30% vs. 47%). There were no significant differences between participating and non-participating probands on variables of race or group status. For mothers, results of the chi-square analyses examining participants versus non-participants indicated the presence of significant differences on the variables of child gender ($\chi^2(1, N = 175) = 5.11, p < .05$) with more mothers of male than female probands participating (37% vs. 22%), and child race ($\chi^2(1, N = 175) = 22.74, p < .001$) with more mothers of white than black probands participating (45% vs. 13%). There was no difference between participating and non-participating mothers when examining proband group status (see Table 3).

Table 3

Demographic Characteristics of Recruited Mothers and Probands

	<u>Mother</u>		<u>Proband</u>	
	Participant (N=50) N(%)	Non-Participant (N=125) N(%)	Participant (N=70) N(%)	Non-Participant (N=105) N(%)
Proband Sex				
Female	21 (42%)	76 (61%)	46 (66%)	51 (49%)
Male	29 (58%)	49 (39%)	24 (34%)	54 (51%)
Ethnicity				
White	35 (70%)	43 (34%)	34 (49%)	44 (42%)
Black	10 (20%)	67 (54%)	29 (41%)	48 (46%)
Hispanic	5 (10%)	8 (6%)	7 (10%)	6 (6%)
Asian	0 (0%)	3 (2%)	0 (0%)	3 (3%)
Other	0 (0%)	4 (3%)	0 (0%)	4 (4%)
Group Status				
SocAnh	25 (50%)	64 (51%)	33 (47%)	56 (53%)
Control	25 (50%)	61 (49%)	37 (53%)	49 (47%)

To determine the equivalence between the social anhedonic and control groups of those who participated, chi-square analyses examining differences on demographic variables (i.e., sex, ethnicity) were computed for both mother and

proband participants (see Table 4). For participating probands, there were no significant differences between the groups on variables of sex or race. Similarly, for mothers that participated, there were no differences between social anhedonic and control groups on the variables of proband sex or proband race. Thus, although there were significant demographic differences observed between participants and those not completing the mailed survey, it does not appear as though the groups that comprise the final sample for the current study differ with regard to demographic variables.

Table 4

Demographic Characteristics of Participating Mothers and Probands

	Mother Participants		Proband Participants	
	SocAnh (N=25)	Control (N=25)	SocAnh (N=37)	Control (N=33)
Proband Sex				
Female	13 (52%)	8 (32%)	23 (62%)	23 (70%)
Male	12 (48%)	17 (68%)	14 (38%)	10 (30%)
Ethnicity				
White	18 (72%)	17 (68%)	17 (46%)	17 (51%)
Black	4 (16%)	6 (24%)	17 (46%)	12 (36%)
Hispanic	3 (12%)	2 (8%)	3 (8%)	4 (12%)

Reliability of CBCL and YSR

Convergence of parent and proband reports of childhood behaviors on the retrospective CBCL and YSR were assessed. Two summary scores, internalizing and externalizing, were computed from the CBCL and YSR subscales to reduce the number of comparisons from eight to six. This is consistent with analyses in previous reports (St. Hilaire et al., 2005). The withdrawn, anxious-depressed and somatic complaints subscales were combined into an internalizing summary score.

Correlation coefficients for these two subscales for proband reports were significant, with r 's of 0.73 and 0.77 ($ps < .001$) for the 6-12 and 13-18 age periods respectively. For parent ratings, correlation coefficients were also high, ranging from 0.83 to 0.85 ($ps < .001$) over the 0-5, 6-12 and 13-18 age periods. The aggression and delinquency subscales were combined into an externalizing summary score. Correlation coefficients for these two subscales were significant for proband ratings, with r 's of 0.58 and 0.69 for the two age periods. For parent ratings, correlation coefficients were also significant, ranging from 0.68 to 0.79 over the three age periods.

Table 5

Cronbach's Alpha, Scale Mean and Scale Standard Deviation for Subscales of the Parent Retrospective Report on the CBCL and Proband Retrospective Report on the YSR

	<u>Parent Report</u>			<u>Proband Report</u>		
	α	Mean	SD	α	Mean	SD
Internalizing						
0-5 years	.93	3.85	6.74	-	-	-
6-12 years	.92	5.25	7.26	.91	11.58	9.11
13-18 years	.94	6.79	9.33	.91	14.37	9.66
Externalizing						
0-5 years	.91	4.98	6.35	-	-	-
6-12 years	.92	4.86	7.00	.90	10.83	8.51
13-18 years	.94	5.98	8.80	.91	12.67	9.42
Social Prob.						
0-5 years	.83	1.68	2.53	-	-	-
6-12 years	.82	1.31	2.31	.58	3.14	2.37
13-18 years	.85	1.24	2.46	.55	2.51	2.10
Thought Prob.						
0-5 years	.80	0.57	1.62	-	-	-
6-12 years	.38	0.55	1.04	.80	1.64	2.62
13-18 years	.71	0.65	1.47	.67	1.47	2.07
Attention Prob.						
0-5 years	.76	2.12	2.70	-	-	-
6-12 years	.77	1.80	2.54	.71	4.80	3.14
13-18 years	.88	2.20	3.38	.72	4.68	3.16
Total Score						
0-5 years	.91	16.93	13.43	-	-	-
6-12 years	.94	13.71	14.78	.95	57.12	25.99
13-18 years	.97	15.21	20.68	.94	61.33	24.47

Cronbach's alpha was used to assess internal consistency of the CBCL and YSR scales (internalizing, externalizing, social problems, thought problems, attention problems, total score). For all age periods of both parent and proband internalizing and externalizing summary scores, reliability estimates were high. The Cronbach's alpha estimates for the remaining subscales were somewhat lower, yet generally fell within the acceptable range (see Table 5). The one exception was the thought problems scale rated by the parent in the 6-12 age period ($\alpha = .38$).

Convergence of Parent and Proband Report

Correlations between mother and proband ratings on the CBCL and YSR were conducted for the ratings of internalizing, externalizing, attention, social problems, thought problems and the total score rating for the age ranges of 6-12 and 13-18 (see Table 6). For reports on the 6-12 age range, correlations between mother and proband were significant for the internalizing subscale ($r=.61, p<.05$), externalizing subscale ($r=.49, p<.05$), social problems subscale ($r=.41, p<.05$), attention subscale ($r=.54, p<.05$), and the total score ($r=.43, p<.05$). The correlation between mother and proband reports on the thought problems ($r=.34, p=.06$) subscale showed a trend towards significance. For the reports on the 13-18 age range, correlations between mother and proband reports were significant for the internalizing subscale ($r=.53, p<.05$), thought problems subscale ($r=.78, p<.001$), attention subscale ($r=.64, p<.05$), and the total score ($r=.41, p<.05$). Correlations for externalizing ($r=.24, p>.05$) and social problems ($r=.04, p>.05$) subscales were not significant.

Table 6

Correlations Between Mother and Proband Ratings from the Child Behavior Checklist (CBCL) and the Youth Self-Report (YSR) Behavior Dimension Scores.

Scale	Age 6-12	Age 13-18
Internalizing	0.61**	0.53**
Externalizing	0.49*	0.24
Social Problems	0.41*	0.04
Thought Problems	0.35	0.78**
Attention Problems	0.54*	0.64**
Total Problems	0.43*	0.41*

Note. * $p < .05$, two tailed, ** $p < .01$, two tailed

Note. Only items included in both CBCL and YSR were in the analysis.

Table 7

Paired Sample T-tests Between Mother and Proband Reports By Age Period

	Mother Report Mean (SD)	Proband Report Mean (SD)	df	t
Internalizing				
6-12 years	3.58 (5.61)	9.85 (9.63)	26	4.17**
13-18 years	5.36 (8.13)	12.18 (9.25)	27	3.89**
Externalizing				
6-12 years	3.41 (5.79)	9.81 (6.03)	26	4.96**
13-18 years	3.48 (5.31)	10.00 (6.34)	26	4.78**
Social Problems				
6-12 years	0.74 (1.37)	2.56 (2.15)	26	6.53**
13-18 years	0.63 (1.31)	2.04 (1.87)	26	4.42**
Thought Problems				
6-12 years	0.36 (0.62)	1.46 (2.63)	27	2.19*
13-18 years	0.68 (1.59)	1.21 (1.99)	27	2.29*
Attention Problems				
6-12 years	1.29 (1.82)	4.35 (2.70)	27	5.33**
13-18 years	1.44 (2.34)	4.22 (3.06)	26	4.89**
Total Score				
6-12 years	9.19 (10.29)	28.92 (18.73)	25	5.89**
13-18 years	12.96 (16.35)	33.11 (18.35)	25	5.41**

Note. * $p < .05$, two tailed, ** $p < .01$, two tailed

Paired sample t-tests were conducted separately for the 6-12 and 13-18 age ranges between the mother and proband reports of each of the CBCL and YSR dimensions (i.e., internalizing, externalizing, attention, social problems, thought problems, total score). For the 6-12 age range, statistically significant differences were observed between informants for all subscales, with proband ratings consistently higher than mother ratings. Similar results were obtained for the 13-18 age range, with the presence of significant differences between informants for all subscales and a consistent pattern of probands providing higher ratings than mothers (see Table 7).

Parent Retrospective Ratings of Childhood Behavior

To test the hypothesis that the social anhedonic group would exhibit elevated mother rated childhood behavior problems compared to controls, as well as assess for the presence of increasing behavior problems with age, a repeated-measures analysis of variance (ANOVA) was conducted. For this analysis, proband group status (social anhedonic vs. control) was entered as the between subjects factor and age period (0-5, 6-12, 13-18) was entered as the within-subjects factor when assessing each of the parent rated CBCL dimensions individually (internalizing, externalizing, social problems, thought problems, attention problems, total problems).

For the internalizing dimension, the main effect for group was significant, $F(1,43) = 4.39$, $p < .05$, with the social anhedonic group exhibiting higher mean scores than controls. This group difference represents a medium effect size, $d = .64$ (Cohen, 1988). The main effect for age was significant, $F(1,43) = 7.56$, $p < .01$, indicating the

presence of increasing mother rated internalizing problems with age. The group by age interaction was not significant, $F(1,43) = 0.05$, $p > .05$.

Analysis of the externalizing dimension did not reveal a significant main effect for group, $F(1,42) = 1.63$, $p > .05$. However, the group difference represents a small effect size, $d = .37$ (Cohen, 1988), with social anhedonics exhibiting higher ratings than controls. Neither the main effect for age, $F(1,42) = 3.15$, $p = .08$, nor the group by age interaction, $F(1,42) = 0.02$, $p > .05$, reached significance.

For the social problems dimension, the main effect for group was not significant, $F(1,47) = 0.68$, $p > .05$. However, the group difference represents a small effect size, $d = .24$ (Cohen, 1988), with social anhedonics receiving higher ratings than controls. The main effect for age reached significance $F(1,47) = 4.80$, $p < .05$, indicating increasing social problems with age. The group by age interaction, $F(1,47) = 2.63$, $p > .05$, failed to reach significance.

Results from analysis of the thought problems dimension indicate that the main effect for group was not significant, $F(1,45) = 0.51$, $p > .05$. However, the group difference represents a small effect size, $d = .21$ (Cohen, 1988), with social anhedonics receiving higher scores than controls. The main effect for age, $F(1,45) = 0.19$, $p > .05$, and the group by age interaction, $F(1,45) = 0.54$, $p > .05$, were both non-significant.

For the attention problems dimension, the main effect for group was not significant, $F(1,47) = 0.97$, $p > .05$. However, the difference between groups represents a small effect size, $d = .29$, with the social anhedonic group receiving

higher ratings than controls. Both the main effect for age, $F(1,47) = 0.19, p > .05$ and the group by age interaction, $F(1,47) = 0.66, p > .05$ failed to reach significance.

Results from analyses of the total score indicated that the main effect for group was not significant, $F(1,37) = 2.38, p > .05$. Neither the main effect for age, $F(1, 37) = 1.62, p > .05$, nor the group by age interaction, $F=0.10, p > .05$, reached significance.

Table 8

Means and Standard Deviations of Mother Rated CBCL Subscales

	Social Anhedonic		Control	
	Mean	SD	Mean	SD
Internalizing				
0-5 years	7.05	9.10	2.43	3.31
6-12 years	8.91	9.45	3.62	3.94
13-18 years	9.95	11.46	5.86	7.25
Externalizing				
0-5 years	5.50	7.93	3.45	4.41
6-12 years	5.82	8.50	2.95	3.76
13-18 years	7.64	10.90	5.30	6.48
Social Problems				
0-5 years	2.42	3.55	1.52	1.47
6-12 years	2.08	3.36	1.22	1.86
13-18 years	1.54	3.13	1.39	2.44
Thought Problems				
0-5 years	2.00	3.86	1.13	1.54
6-12 years	1.38	2.77	1.00	1.41
13-18 years	1.86	3.42	1.67	2.39
Attention Problems				
0-5 years	2.83	3.46	2.39	2.71
6-12 years	2.79	3.71	1.70	2.36
13-18 years	3.42	4.77	2.22	3.37
Total Score				
0-5 years	19.84	26.13	9.78	9.68
6-12 years	20.42	25.46	8.89	8.50
13-18 years	22.42	28.02	14.00	17.82

Proband Retrospective Ratings of Childhood Behavior

To test the hypothesis that the social anhedonic group would exhibit elevated proband rated childhood behavior problems compared to controls, as well as assess

for the presence of increasing behavior problems with age, a repeated-measures analysis of variance (ANOVA) was conducted. For this analysis, proband group status (social anhedonic vs. control) was entered as the between subjects factor and age period (6-12, 13-18) was entered as the within-subjects factor when assessing each of the proband rated CBCL dimensions individually (internalizing, externalizing, social problems, thought problems, attention problems, total problems).

Table 9

Means and Standard Deviations of Proband Rated YSR Subscales

	Social Anhedonic		Control	
	Mean	SD	Mean	SD
Internalizing				
6-12 years	14.95	9.84	9.03	7.24
13-18 years	17.24	9.72	10.60	8.33
Externalizing				
6-12 years	11.57	10.20	8.52	6.19
13-18 years	18.76	11.36	12.13	9.63
Social Problems				
6-12 years	4.44	3.11	3.68	2.29
13-18 years	3.77	2.32	3.45	2.43
Thought Problems				
6-12 years	3.59	4.28	1.00	1.72
13-18 years	3.57	3.54	1.77	2.45
Attention Problems				
6-12 years	5.36	3.55	4.53	3.86
13-18 years	5.44	3.70	4.28	4.02
Total Score				
6-12 years	38.03	22.18	25.62	16.12
13-18 years	45.37	21.27	30.85	21.78

For the internalizing dimension, a significant main effect for group was observed, $F(1,67) = 10.34$, $p < .01$, with social anhedonics exhibiting higher means scores than controls. This group difference represents a large effect size, $d = .80$ (Cohen, 1988). Additionally, analyses indicated the presence of a trend for a main effect for age, $F(1,67) = 3.64$, $p = .06$, in a direction indicating increasing internalizing

problems with age. The group by age interaction was not significant, $F(1,67) = 0.13$, $p > .05$.

Analysis of the externalizing dimension did not reveal a significant main effect for group, $F(1,68) = 2.25$, $p > .05$. The group difference for this dimension represents a small effect size, $d = .37$ (Cohen, 1988). The main effect for age was significant, $F(1,68) = 26.88$, $p < .01$, indicating the presence of increasing externalizing problems with age. The group by age interaction was not significant, $F(1,68) = 0.15$, $p > .05$.

For the social problems dimension, the main effect of group was not significant, $F(1,68) = 0.98$, $p > .05$, and the effect size representing the differences between groups was small, $d = .25$ (Cohen, 1988). The main effect for age was not significant, $F(1,68) = 2.18$, $p > .05$. The group by age interaction was not significant, $F(1,68) = 0.53$, $p > .05$.

Analysis of the thought problems dimension revealed a significant main effect for group, $F(1,67) = 8.81$, $p < .01$, with social anhedonics providing higher ratings than controls. This group difference represents a large effect size, $d = .87$ (Cohen, 1988). There was not a significant main effect for age, $F(1,67) = 1.55$, $p > .05$, and the group by age interaction was not significant for this dimension, $F(1,67) = 1.78$, $p > .05$.

For the attention problems dimension, the main effect for group was not significant, $F(1,68) = 1.37$, $p > .05$. This group difference represents a small effect size, $d = .28$ (Cohen, 1988). There was no significant main effect for age, $F(1,68) = 0.06$, $p > .05$, or group by age interaction, $F(1,68) = 0.24$, $p > .05$.

Analyses of the total problems dimension indicated the presence of a significant main effect for group, $F(1, 61) = 7.42, p < .05$. This group difference represents a large effect size, $d = .84$. The main effect for age reached significance, $F(1, 61) = 9.39, p < .05$. The group by age interaction was not significant, $F(1, 61) = 0.27, p > .05$.

Correlations Between Childhood Behavior and Schizophrenia Spectrum Ratings

The hypothesis that childhood behavior would be related to schizophrenia-spectrum disorder dimensional ratings from the IPDE was assessed through correlational analyses. These analyses were conducted separately for the control and social anhedonic groups. Correlations were computed between the six CBCL/YSR behavioral dimensions (internalizing, externalizing, social problems, attention problems, thought problems, total score) and the schizophrenia-spectrum dimensional scores (schizotypal, schizoid, paranoid).

In an attempt to decrease the number of correlations computed, and reduce family-wise error, the dimensions of the retrospective CBCL/YSR were correlated across time periods for each informant to determine the appropriateness of utilizing composite indices. For probands, correlations between ratings of the 6-12 and 13-18 age periods for each dimension were consistently strong, with r 's ranging from .55 to .82, ($ps < .01$). For mothers, correlations between ratings of the 0-5, 6-12 and 13-18 age periods for each dimension were also consistently strong, with r 's ranging from .43 to .94 ($ps < .01$). As there generally was evidence of continuity across time periods, subscale ratings were summed across age periods to create a composite index

for each behavioral dimension to be used in correlations with schizophrenia-spectrum dimensional ratings (schizotypal, schizoid, paranoid) for both probands and mothers.

Parent Ratings

Correlations between mother rated CBCL dimension composite scores and IPDE dimensional score for schizotypal, schizoid and paranoid dimensions scores for the social anhedonic group are found in Table 10. Ratings of schizotypal personality symptoms did not correlate significantly with any of the mother rated behavioral dimension composites. Significant positive correlations were observed between schizoid personality symptoms and mothers composite ratings of social problems ($r=.58$, $p=.01$), attention problems ($r=.48$, $p<.05$), thought problems ($r=.58$, $p<.01$), total score ($r=.53$, $p<.05$). Additionally, the correlation observed between schizoid symptoms and mother rated externalizing problems ($r=.41$, $p=.06$), as well as between paranoid personality disorder symptom ratings and mother composite ratings of social problems ($r=.40$, $p=.06$), showed trends towards significance. Correlational analyses of control group parent ratings revealed no significant correlations between any behavioral dimension and the schizophrenia-spectrum dimension ratings.

Table 10

Correlations Between Mother Rated Behavioral Dimension Composite Scores and Schizophrenia-Spectrum Personality Disorder Dimensional Scores (SocAnh)

	Schizotypal Dimensional Score	Schizoid Dimensional Score	Paranoid Dimensional Score
Internalizing N=22	.28	.18	.30
Externalizing N=22	.14	.41	.27
Social Problems N=24	.30	.58**	.40
Attention Problems N=24	.22	.48*	.33
Thought Problems N=23	.13	.58**	.13
Total Problems N=19	.05	.53*	.16

Note. * $p < .05$, two tailed, ** $p < .01$, two tailed

Outlier analyses indicated that mother ratings for one proband in the social anhedonic group were significantly elevated for each of the six behavioral dimensions. Inspection of the data determined that these ratings were in fact indicative of the problems this particular proband had throughout childhood. However, given the small sample of mother ratings in this particular study, it is possible that this outlier could affect the strength of relationships between variables. As such, the above correlational analyses were repeated for the social anhedonic group, with the exclusion of the mother ratings of this outlier (see Table 11).

Table 11

Correlations Between Mother Rated Behavioral Dimension Composite Scores and Schizophrenia-Spectrum Personality Disorder Dimensional Scores, With Outlier Excluded (SocAnh)

	Schizotypal Dimensional Score	Schizoid Dimensional Score	Paranoid Dimensional Score
Internalizing N=21	.50*	-.15	.47*
Externalizing N=21	.40	.13	.51*
Social Problems N=23	.63**	.39	.71**
Attention Problems N=23	.36	.31	.46*
Thought Problems N=20	.49*	.25	.40
Total Score N=12	.55	.53	.45

Note. * $p < .05$, two tailed, ** $p < .01$, two tailed

Significant positive correlations were observed between schizotypal dimensional ratings of the internalizing, social problems and thought problems subscales ($p < .05$). Additionally, the correlation between schizotypal ratings and the total score showed a trend towards significance ($r = .55$, $p = .06$). Positive significant correlations were also observed between paranoid dimensional ratings and each of the mother composite behavioral dimension ratings ($p < .05$), with the exception of the thought problems ($r = .25$, $p < .05$) and total score dimensions ($r = .45$, $p > .05$).

Proband Ratings

Correlations between proband rated YSR dimension composite scores and IPDE dimensional score for schizotypal, schizoid and paranoid dimensions scores for the social anhedonic group are found in Table 12. No significant correlations emerged between either the schizotypal or schizoid dimensional symptom ratings and the proband rated behavioral dimensions. The thought problems rating correlate

significantly with paranoid dimensional scores ($r=.38$, $p<.05$). For the control group, schizoid dimensional scores did not correlate significantly with any of the proband rated behavior dimension composite scores. A significant correlation was observed between the paranoid dimensional symptom ratings and proband rated attention problems ($r=.38$, $p<.05$) and between schizotypal dimensional ratings and the total score ($r=.49$, $p<.05$).

Table 12

Correlations Between Proband Rated Behavioral Dimension Composite Scores and Schizophrenia-Spectrum Personality Disorder Dimensional Scores (SocAnh)

	Schizotypal Dimensional Score	Schizoid Dimensional Score	Paranoid Dimensional Score
Internalizing N=36	.08	.10	.25
Externalizing N=36	-.12	-.11	.30
Social Problems N=36	-.02	-.10	.28
Attention Problems N=35	-.10	.22	-.02
Thought Problems N=35	.26	.11	.38*
Total Score N= 34	.08	.10	.26

Note. * $p<.05$, two tailed, ** $p<.01$, two tailed

Developmental Milestones

Univariate ANOVA analyses were used to assess group differences for each of the six developmental milestones (sitting, crawling, standing, walking, teething, talking), as rated by mothers (early, on time, late). Analyses did not reveal any significant differences between groups. However, the milestone of walking reached a trend level of significance ($F(1,48)=3.21$, $p=.08$), with social anhedonics walking later than controls. This group difference represents a medium effect size ($d = .51$) (Cohen, 1988). The age at each milestone attainment (early, on time, late) was then

correlated with the three schizophrenia-spectrum dimensional scores (schizotypal, schizoid, paranoid). Results revealed a significant correlation between timing of walking and the schizotypal dimensional score ($r=.28$, $p<.05$), and correlations showing a trend towards significance between walking and the paranoid dimensional scores ($r=.26$, $p=.07$), crawling and the schizotypal dimensional score ($r=.25$, $p=.09$), and crawling and the paranoid dimensional score ($r=.25$, $p=.08$).

Chapter 5: Discussion

The present study investigated retrospective ratings of childhood behavior and developmental milestones of those psychometrically identified as high risk for schizophrenia spectrum disorders. It was hypothesized that the social anhedonic group would have significantly more parent and proband rated childhood behavior problems. Further, it was predicted that greater child behavior problems would be related to increased levels of current schizophrenia-spectrum symptomatology within the social anhedonic group. Finally, it was hypothesized that social anhedonics would exhibit greater mother rated delays in developmental milestone attainment compared to controls, and that greater milestone delays within the social anhedonic group would be related to higher levels of schizophrenia-spectrum symptom ratings.

Unlike previous retrospective reports of childhood behavior within the domain of schizophrenia risk investigations (Baum, 1995; Neumann, 1995; Walker & Baum, 1998; Rossi, Pollice, Daneluzzo, Marinangeli & Stratta, 2000), which utilize only mother report of the probands' childhood behavior, the current study assessed both mother and child perspectives. The addition of the proband informant not only allows for increased confidence in the validity of such retrospective reports, but also allows access to information about the proband that is potentially not fully accessible to a parent- such as thought problems or internalizing problems, as suggested by Miller and colleagues (Miller, Byrne, Hodges, Laurie & Johnstone, 2002).

When comparing the average correlations between parent and proband reports on the six analyzed subscales of the retrospective CBCL and YSR with previous

reports of convergence on the two measures (Achenbach, Dumenci & Rescorla, 2003; Sounder, Helstela & Helenius, 1999), the results are strikingly similar (average $r=.41$ and $r=.38-.45$, respectively). Thus, parent-child ratings show a modest amount of convergence, sharing approximately 16% of the variance. Additionally, results of the present study that indicate significant elevations of child rated behavior problems on the YSR when compared with parent ratings on the CBCL are also consistent with previous results (Achenbach, Dumenci & Rescorla, 2003; Sounder, Helstela & Helenius, 1999). These consistencies, in combination with the adequate reliability observed for both the retrospective CBCL and YSR measures used in the current study, lend support for the use of these measures in a retrospective manner.

Consistent with the hypothesis that parent rated childhood behavior problems of social anhedonics would be significantly greater than those for controls, repeated measures analysis revealed a significant group difference for the internalizing subscale of the CBCL. However, none of the remaining subscales (externalizing, social problems, thought problems, attention problems, total score) exhibited group differences. The results indicating a general lack of significant group differences are inconsistent with those obtained in previous investigations utilizing the retrospective CBCL to assess the childhoods of those diagnosed with schizotypal personality disorder (Walker & Bam, 1998) and schizophrenia (Neumann, 1995; Baum, 1995; Rossi, Pollice, Daneluzzo, Marinangeli & Stratta, 2000). These studies reported group differences ranging from the attention, social, and thought problems subscales (Neumann, 1995; Baum, 1995; Walker & Baum, 1998) to all six behavior problem dimensions (Rossi, Pollice, Daneluzzo, Marinangeli & Stratta, 2000). The current

finding that ratings of internalizing and social problems increased significantly with age is consistent with the previously reported findings of escalating behavior problems over time across the CBCL subscales (Neumann, 1995, Baum, 1995, Walker & Baum, 1998; Rossi, Pollice, Daneluzzo, Marinangeli & Stratta, 2000).

As hypothesized, self-report ratings of childhood behavior problems were greater in social anhedonics than controls on the internalizing, thought problems and the total score subscales. Additionally, two out of the five subscales, internalizing problems and total score, exhibited main effects of age with the expected pattern of increasing problems over time. Overall, these findings suggest that those who are currently classified as social anhedonic rate some domains of their childhood as deviant when compared to controls, consistent with previously cited studies utilizing maternal reports.

It is unclear why group differences emerged more readily in proband reported but not mother-rated childhood behavior problems. One possible explanation for this observed difference in results is that mothers may not have knowledge about some internal experiences, such as thought problems, had by their children. Therefore, mothers may be less likely to endorse those items even when such problems are present. Second, as is suggested by the replicated finding of modest convergence between mother and child report of childhood behaviors, it may be that parents and children simply have different views regarding the extent of problematic behavior. Third, the sample size of proband informants was larger than that of mother informants, presenting the possibility that the increased power for analyses of proband rated data allowed for group differences to reach significance. Fourth, the

rates of participation differed significantly by gender within the proband and mother informant groups, with more female proband reports than males and more mother reports on male than female probands. It is thus possible that these gender differences within and between the informant groups could contribute to the observed differing patterns of results.

The relationship between mothers' ratings of childhood behavior problems and schizophrenia-spectrum dimensional ratings made for schizotypal, schizoid, and paranoid personality disorder symptoms within the social anhedonic group were assessed. Analyses completed with the inclusion of all mother data resulted in significant correlations between the schizoid dimensional score and the mother rated behavioral dimensions of social problems, attention problems, thought problems, and the total score, with a trend toward significance for the externalizing dimension. Additionally, a significant correlation was observed between the paranoid dimensional score and attention problems. The removal of an outlier in the data changed the pattern of correlations considerably, resulting in significant relationships between the schizotypal dimensional score and the internalizing, social problems, and thought problems subscales, as well as between the paranoid dimensions and the internalizing, externalizing, social problems and attention problems subscales. Thus, within the social anhedonic group, mother reports of greater childhood behavior problems were associated with greater current clinician-rated symptom severity, although the pattern of results was found to vary substantially with the inclusion versus exclusion of an outlier. The relationship between these variables should be assessed in future studies with larger sample sizes.

Correlational analysis of proband rated childhood behavior and schizophrenia-spectrum dimensional ratings produced far fewer significant relationships than was produced with the mother data. The only significant correlation was observed between the thought problems dimension and paranoid dimensional ratings. None of the remaining behavioral dimensions (internalizing, externalizing, social problems, attention problems, total score) exhibited a significant relationship with schizophrenia-spectrum symptom ratings.

As described above, the patterns obtained using the mother versus proband rated childhood behavior problem data in correlation with clinician rated schizophrenia-spectrum symptom ratings were quite different. The possible reasons behind this difference are worthy of consideration. First, the number of significant correlations obtained utilizing mother information could in part be influenced by shared method variance, in that both the mother rated childhood behavior problems and interviewer rated spectrum symptoms are both based on the perceptions of an observer. Second, it is possible that in retrospectively rating childhood problems mothers had a tendency to allow the current functioning of their child to influence their views of past problems. This contamination of ratings of previous behavior could result in spuriously high correlations with the interviewer ratings of current symptom levels.

With regards to maternal ratings of developmental milestone attainment, it was hypothesized that the social anhedonic group would exhibit a delay in attainment compared to controls. Results did not support this hypothesis, as there were no significant group differences observed for any of the developmental milestones

assessed (sitting, crawling, standing, walking, teething, talking). However, the group difference for the walking milestone approached significance, with a medium range effect size of $d=0.51$. This is of particular interest given that the milestone of walking has demonstrated significant group differences between those who later developed schizophrenia and those that did not in previous cohort investigations, including the 1946 National Survey of Health and Development birth cohort (Jones, Rodgers, Murray & Marmot, 1994) and the Dunedin Multidisciplinary Health and Development Study (Canon et al., 2002).

Additionally, walking was the only milestone in the present study to exhibit a hypothesized significant correlation with any of the three schizophrenia-spectrum dimensional scores (schizotypal, schizoid, paranoid) within the social anhedonic group, with the relationship between walking and schizotypal scores reaching significance. Further, the relationship between walking and paranoid dimensional scores approached significance. Crawling also exhibited trend level correlations with the schizotypal and paranoid dimensional ratings.

Given the small sample size obtained for these analyses, results must be interpreted cautiously. However, these results do provide some initial support for the idea that those in the social anhedonic risk group may exhibit similar milestone delays observed in previous cohort investigations. Additionally, these delays may show some association with ratings made of psychopathology in early adulthood. Further research with larger sample sizes is warranted to determine the nature of these group differences and relationships with later psychopathology.

Perhaps the most significant limitation of the current research is the small sample size obtained for both the mother and proband groups. In particular, the relative absence of significant findings obtained with the ratings made by mothers in the current study, in comparison with the previously reported outcomes, may in part be a result of low power due to the small sample size. The mother participation rate (28%) was much lower than that of probands (40%). This difference in participation could be a product of the limited contact the research team has had with mothers throughout the course of the longitudinal study, versus the regular contact that was maintained with probands.

Relatedly, due to the small sample size there was not sufficient power to investigate sex differences. Previous studies have observed important differences with regards to gender. For instance Souder and colleagues (1999) determined that females self-report more problems than males, and further, that the difference between self and parent informant ratings is significantly greater for females. Additionally, the genetic high risk project reported by Hans and colleagues (1992) demonstrated that while the strongest discriminator between risk and control subjects was social withdrawal behaviors, this finding primarily related to male subjects. With regards to the current sample, the presence of differential participation rates by gender of the proband should be noted. More female probands returned questionnaires than males, and mothers were more likely to return questionnaires reporting on male than female probands. These differences in group composition may have contributed to the differing patterns of results observed between the

informant groups. Sex differences should be explored in future research with larger sample sizes.

Another limitation of the present study is the utilization of retrospective measures to report on childhood problems. Clearly, this methodology raises questions regarding potential recall bias and the overall accuracy of retrospective reporting based on memory (Henry, Moffitt, Caspi, Langley & Silva, 1994; Rutter, 1998). However, as the first study of child factors in social anhedonics, this study has the potential to add to the growing literature on at-risk individuals by utilizing a risk paradigm that avoids some of the limitations that are present in other methodologies. Many of the previously conducted studies investigating childhood behavior problems and developmental milestones utilize a genetic high risk paradigm in subject recruitment, meaning that subjects have mothers with a diagnosis of schizophrenia. This is problematic when considering that 94% of those who develop schizophrenia do not have a parent with the disorder (Gottesman, 1991). Additionally, follow-back studies that ask questions about childhood after the development of the disorder (Neumann, 1995, Baum, 1995, Walker & Baum, 1998; Rossi, Pollice, Daneluzzo, Marinangeli & Stratta, 2000) are also problematic in that the presence of the disorder could play a role in biasing recollection of childhood behavior. The utilization of the psychometric high-risk paradigm in the current study identified subjects using social anhedonia as a fallible indicator of heightened risk to develop schizophrenia and spectrum disorders. By using subjects identified in this manner, some limitations of previous research can be avoided by the broadening of subject recruitment beyond children of mothers with schizophrenia, as well as asking retrospective questions

regarding childhood before the development of diagnosable psychiatric illness. It is possible that assessing the childhood of the probands in this manner, prior to deterioration to a degree that would warrant diagnosis, could serve to reduce the amount of bias present functioning would have on ratings of past behavior to some degree. While there are limitations to the retrospective design of the current study, it nevertheless provides some basis for further work examining childhood factors related to schizotypy and allows for a comparison of results among recruitment strategies. One way to gain confidence in the retrospective reports would be to obtain independent confirmation of past problems such as school reports or psychiatric records. This information was not obtained for the current study, but would be a useful addition to future work in this area.

The potential effect of the characteristics of the risk sample utilized in the present study also warrants discussion. In contrast to previous studies which obtained information on probands with diagnosable psychiatric illness, the sample for the current investigation is thought to be at risk for reaching the diagnostic threshold in the future. With that, the social anhedonic risk sample includes some number of false positives that may obscure the true differences between those who are in fact at risk for later illness and the control group. Additionally, the probands in this study were assessed at the age of eighteen, which is early in the risk period for schizophrenia and related disorders. Therefore, the ultimate diagnostic outcome of members of the risk group is not yet known. Future analyses should be conducted with follow-up data obtained later in the risk period.

Appendices

Appendix A: Screening Questionnaire

Magical Ideation Scale

1. I have occasionally had the silly feeling that a TV or radio broadcaster knew I was listening to him. (True)
2. I have felt that there were messages for me in the way things were arranged, like in a store window. (True)
3. Things sometimes seem to be in different places when I get home, even though no one has been there. (True)
4. I have never doubted that my dreams are the products of my own mind. (False)
5. I have noticed sounds on my records that are not there at other times. (True)
6. I have had the momentary feeling that someone's place has been taken by a look-alike (True)
7. I have never had the feeling that certain thoughts of mine really belonged to someone else. (False)
8. I have wondered whether the spirits of the dead can influence the living. (True)
9. At times I perform certain little rituals to ward off negative influences. (True)
10. I have felt that I might cause something to happen just by thinking too much about it. (True)
11. At times, I have felt that a professor's lecture was meant especially for me. (True)
12. I have sometimes felt that strangers were reading my mind. (True)
13. If reincarnation were true, it would explain some unusual experiences I have had. (True)
14. I sometimes have a feeling of gaining or losing energy when certain people look at me or touch me. (True)

The Perceptual Aberration Scale

1. I sometimes have had the feeling that some parts of my body are not attached to the same person. (True)
2. Occasionally I have felt as though my body did not exist. (True)
3. Sometimes people whom I know well begin to look like strangers. (True)
4. My hearing is sometimes so sensitive that ordinary sounds become uncomfortable. (True)
5. Often I have a day when indoor lights seem so bright that they bother my eyes. (True)
6. My hands or feet have never seemed far away. (False)
7. I have sometimes felt confused as to whether my body was really my own. (True)
8. Sometimes I have felt that I could not distinguish my body from other objects around me. (True)
9. I have felt that my body and another person's body were one and the same. (True)
10. I have felt that something outside my body was a part of my body. (True)
11. I sometimes have the feeling that my body is abnormal. (True)

12. Now and then, when I look in the mirror, my face seems quite different from usual. (True)
13. I have never had the passing feeling that my arms or legs have become longer than usual. (False)
14. I have sometimes felt that some part of my body no longer belongs to me. (True)
15. Sometimes when I look at things like tables and chairs, they seem strange. (True)
16. I have felt as though my head or limbs were somehow not my own. (True)
17. Sometimes part of my body has seemed smaller than it usually is. (True)
18. I have sometimes had the feeling that my body is decaying inside. (True)
19. Occasionally it has seemed as if my body had taken on the appearance of another person's body. (True)
20. Ordinary colors sometimes seem much too bright to me. (True)
21. Sometimes I have had a passing thought that some part of my body was rotting away. (True)
22. I have sometimes had the feeling that one of my arms or legs is disconnected from the rest of my body. (True)
23. It has seemed at times as if my body was melting into my surroundings. (True)
24. I have never felt that my arms or legs have momentarily grown in size. (False)
25. The boundaries of my body always seem clear. (False)
26. Sometimes I have had feelings that I am united with an object near me. (True)
27. Sometimes I have had the feeling that a part of my body is larger than it usually is. (True)
28. I can remember when it seemed as though one of my limbs took on an unusual shape. (True)
29. I have had the momentary feeling that my body has become misshapen. (True)
30. I have had the momentary feeling that the things I touch remain attached to my body (True)
31. Sometimes I feel like everything around me is tilting. (True)
32. I sometimes have to touch myself to make sure I'm still there. (True)
33. Parts of my body occasionally seem dead or unreal. (True)
34. At times I have wondered if my body was really my own. (True)
35. For several days at a time I have had such a heightened awareness of sights and sounds that I cannot shut them out. (True)

The Infrequency Scale

1. On some mornings, I didn't get out of bed immediately when I first woke up. (False)
2. There have been a number of occasions when people I know have said hello to me. (False)
3. There have been times when I have dialed a telephone number only to find that the line was busy. (False)
4. At times when I was ill or tired, I have felt like going to bed early. (False)
5. On some occasions I have noticed that some other people are better dressed than myself. (False)
6. Driving from New York to San Francisco is generally faster than flying between the cities. (True)

7. I believe that most light bulbs are powered by electricity. (False)
8. I go at least once every two years to visit either northern Scotland or some part of Scandinavia. (True)
9. I cannot remember a time when I talked to someone who wore glasses. (True)
10. Sometimes when walking down the sidewalk, I have seen children playing. (False)
11. I have never combed my hair before going out in the morning. (True)
12. I find that I often walk with a limp, which is a result of a skydiving accident. (True)
13. I cannot remember a single occasion when I have ridden on a bus. (True)

Revised Social Anhedonia Scale

1. Having close friends is not as important as many people say. (True)
2. I attach very little importance to having close friends. (True)
3. I prefer watching television to going out with other people. (True)
4. A car ride is much more enjoyable if someone is with me. (False)
5. I like to make long distance phone calls to friends and relatives. (True)
6. Playing with children is a real chore. (True)
7. I have always enjoyed looking at photographs of friends. (False)
8. Although there are things that I enjoy doing by myself, I usually seem to have more fun when I do things with other people. (False)
9. I sometimes become deeply attached to people I spend a lot of times with. (True)
10. People sometimes think that I am shy when I really just want to be left alone. (True)
11. When things are going really well for my close friends, it makes me feel good too. (False)
12. When someone close to me is depressed, it brings me down also. (False)
13. My emotional responses seem very different from those of other people. (True)
14. When I am alone, I often resent people telephoning me or knocking on my door. (True)
15. Just being with friends can make me feel really good. (False)
16. When things are bothering me, I like to talk to other people about it. (False)
17. I prefer hobbies and leisure activities that do not involve other people. (True)
18. It's fun to sing with other people. (False)
19. Knowing that I have friends who care about me give me a sense of security. (False)
20. When I move to a new city, I feel a strong need to make new friends. (False)
21. People are usually better off if they stay aloof from emotional involvements with most others. (True)
22. Although I know I should have affection for certain people, I don't really feel it. (True)
23. People often expect me to spend more time talking with them than I would like. (True)
24. I feel pleased and gratified as I learn more and more about the emotional life of my friends. (False)
25. When others try to tell me about their problems and hang-ups, I usually listen with interest and attention. (False)
26. I never had really close friends in high school. (True)

27. I am usually content to just sit alone, thinking and daydreaming. (True)
28. I'm much too independent to really get involved with other people. (True)
29. There are few things more tiring than to have a long, personal discussion with someone. (True)
30. It made me sad to see all my high school friends go their separate ways when high school was over. (False)
31. I have often found it hard to resist talking to a good friend, even when I have other things to do. (False)
32. Making new friends isn't worth the energy it takes. (True)
33. There are things that are more important to me than privacy. (False)
34. People who try to get to know me better usually give up after awhile. (True)
35. I could be happy living all alone in a cabin in the woods or mountains. (True)
36. If given the choice, I would much rather be with others than be alone. (False)
37. I find that people too often assume that their daily activities and opinions will be interesting to me. (True)
38. I don't really feel very close to my friends. (True)
39. My relationships with other people never get very intense. (True)
40. In many ways, I prefer the company of pets to the company of people. (True)

Appendix B: International Personality Disorder Examination

Instructions: The questions I am going to ask concern what you are like most of the time. I'm interested in what has been typical of you throughout your life, and not just recently. If you have changed and your answers might have been different sometime in the past, be sure to let me know.

Criteria for Adults: Symptom for the past 5 years, onset before age 25, symptom present within past year

Criteria for Adolescents: Symptom for the past 3 years, symptom present within the past year

Ratings: Each item rated from 0 (denied, rare, not supported by examples) to 2 (almost always, frequently)

SCHIZOTYPAL

1. Ideas of reference (excluding delusions of reference).
2. Odd beliefs or magical thinking that influences behavior and is inconsistent with subcultural norms.
3. Unusual perceptual experiences, including bodily illusions.
4. Odd thinking and speech.
5. Suspiciousness or paranoid ideation.
6. Inappropriate or constricted affect.
7. Behavior or appearance that is odd, eccentric, or peculiar.
8. Lacks close friends or confidants other than first-degree relatives.
9. Excessive social anxiety that does not diminish with familiarity and tends to be associated with paranoid fears rather than negative judgments about self.

SCHIZOID

1. Neither desires nor enjoys close relationships, including being part of a family.
2. Almost always chooses solitary activities.
3. Has little, if any, interest in having sexual experiences with another person.
4. Takes pleasure in few, if any, activities.
5. Lacks close friends or confidants, other than first-degree relatives.
6. Appears indifferent to the praise or criticism of others.
7. Shows emotional coldness, detachment, or flattened affectivity.

PARANOID

1. Suspects, without sufficient basis, that others are exploiting, harming, or deceiving him or her.
2. Is preoccupied with unjustified doubts about the loyalty or trustworthiness of friends or associates.
3. Is reluctant to confide in others because of unwarranted fears that the information will be used maliciously against him or her.
4. Reads hidden demeaning or threatening meanings into benign remarks or events.
5. Persistently bears grudges (i.e., is unforgiving of insults, injuries, or slights)
6. Perceives attacks on his or her character or reputation that are not apparent to others *and* is quick to react angrily or to counterattack.
7. Has recurrent suspicions, without justification, regarding fidelity of spouse or sexual partner.

Appendix C: CBCL/YSR Syndrome Scales

Note: Those subscales found on the CBCL but not the YSR are indicated by italics.

INTERNALIZING

Anxious/Depressed

1. Cried a lot
2. Feared certain animals, situations, or places, other than school
3. Feared he/she might think or do something bad
4. Felt he/she had to be perfect
5. Felt or complained that no one loved him/her
6. Felt worthless or inferior
7. Nervous, highstrung, or tense
8. Too fearful or anxious
9. Felt too guilty
10. Self-conscious or easily embarrassed
11. Talked about killing self
12. Worried

Withdrawn/Depressed

1. There was very little he/she enjoyed
2. Would rather be alone than with others
3. Refused to talk
4. Secretive, kept things to self
5. Too shy or timid
6. Underactive, slow moving, or lacked energy
7. Unhappy, sad, or depressed
8. Withdrawn, didn't get involved with others

Somatic Complaints

1. Had nightmares
2. *Constipated, didn't move bowels*
3. Felt dizzy or lightheaded
4. Overtired without good reason
5. Aches or pains
6. Headaches
7. Problems with eyes (not if corrected by glasses)
8. Rashes or other skin problems
9. Stomachaches
10. Vomiting, throwing up

EXTERNALIZING

Rule-Breaking Behavior

1. Drank alcohol without parents' approval
2. Didn't seem to feel guilty after misbehaving
3. Broke rules at home, school or elsewhere
4. Hung around with others who got in trouble
5. Lied or cheated

6. Preferred being with older kids
7. Ran away from home
8. Set fires
9. *Sexual problems*
10. Stole at home
11. Stole outside the home
12. Swore or used obscene language
13. Thought about sex too much
14. Smoked, chewed, or would sniff tobacco
15. Truancy, skipped school
16. Used drugs for nonmedical purposes (don't include alcohol or tobacco)
17. *Vandalism*

Aggressive Behavior

1. Argued a lot
2. Cruel, bullied, or mean to others
3. Demanded a lot of attention
4. Destroyed his/her own things
5. Destroyed things belonging to his/her family or others
6. Disobedient at home
7. Disobedient at school
8. Got in many fights
9. Physically attacked people
10. Screamed a lot
11. Stubborn, sullen or irritable
12. Sudden changes in mood or feeling
13. *Sulked a lot*
14. Teased a lot
15. Temper tantrums or hot temper
16. Threatened people
17. Unusually loud

SOCIAL PROBLEMS

1. Clung to adults or too dependent
2. Complained of loneliness
3. Didn't get along with other kids
4. Easily jealous
5. Felt others were out to get him/her
6. Got hurt a lot, accident-prone
7. Got teased a lot
8. Not liked by other kids
9. Poorly coordinated or clumsy
10. Preferred being with younger kids
11. Speech problems

THOUGHT PROBLEMS

1. Could not get his/her mind off certain thoughts; obsessions
2. Deliberately harmed self or attempted suicide
3. Heard sounds or voices that weren't there
4. Nervous movements or twitching
5. Picked nose, skin or other parts of body
6. *Played with own sex parts in public*
7. *Played with own sex parts too much*
8. Repeated certain acts over and over; compulsions
9. Saw things that weren't there
10. Slept less than most kids
11. Stored up too many things he/she didn't need
12. Strange behavior
13. Strange ideas
14. *Talked or walked in sleep*
15. Trouble sleeping

ATTENTION PROBLEMS

1. Acted too young for his/her age
2. Failed to finish things he/she started
3. Could not concentrate, could not pay attention for long
4. Could not sit still, was restless, or hyperactive
5. Confused or seemed to be in a fog
6. Daydreamed or got lost in her/her thoughts
7. Impulsive or acted without thinking
8. Poor school work
9. Inattentive or easily distracted
10. *Stared blankly*

References

- Achenbach, T. M., Dumenci, L., & Rescorla, L. A. (2003). Are american children's problems still getting worse? A 23-year comparison. *J Abnorm Child Psychol*, 31(1), 1-11.
- Achenbach, T. M., & Edelbrock, C. S. (1981). Behavioral problems and competencies reported by parents of normal and disturbed children aged four through sixteen. *Monogr Soc Res Child Dev*, 46(1), 1-82.
- Achenbach, T. M., Howell, C. T., McConaughy, S. H., & Stanger, C. (1995). Six-year predictors of problems in a national sample of children and youth: I. Cross-informant syndromes. *J Am Acad Child Adolesc Psychiatry*, 34(3), 336-347.
- Achenbach, T. M., Howell, C. T., Quay, H. C., & Conners, C. K. (1991). National survey of problems and competencies among four- to sixteen-year-olds: Parents' reports for normative and clinical samples. *Monogr Soc Res Child Dev*, 56(3), 1-131.
- Achenbach, T. M., McConaughy, S. H., & Howell, C. T. (1987). Child/adolescent behavioral and emotional problems: Implications of cross-informant correlations for situational specificity. *Psychol Bull*, 101(2), 213-232.
- Achenbach, T. M., & Rescorla, L. A. (2001). Manual for the aseba school-age forms and profiles. Burlington: University of Vermont Research Center for Children, Youth and Families.
- Baum, K. M., & Walker, E. F. (1995). Childhood behavioral precursors of adult symptom dimensions in schizophrenia. *Schizophr Res*, 16(2), 111-120.
- Berube, R. L., & Achenbach, T. M. (2002). Bibliography of published studies using the achenbach system of empirically based assessment (aseba): 2002 edition. Burlington: University of Vermont, Research Center for Children, Youth and Families.
- Blanchard, J. J., & Brown, S. (1999). Social anhedonia and other indicators of schizotypy: Taxometric considerations and group comparisons, *Paper presented at the 14th Annual Meeting of the Society for Research in Psychopathology*. Montreal, Canada.
- Blanchard, J. J., Gangestad, S. W., Brown, S. A., & Horan, W. P. (2000). Hedonic capacity and schizotypy revisited: A taxometric analysis of social anhedonia. *J Abnorm Psychol*, 109(1), 87-95.

- Blanchard, J. J., Mueser, K. T., & Bellack, A. S. (1998). Anhedonia, positive and negative affect, and social functioning in schizophrenia. *Schizophr Bull*, 24(3), 413-424.
- Bleuler, E. (1911). *Dementia praecox or the group of schizophrenia* (J. Zinkin., Trans.). New York, NY: International Universities Press.
- Brocki, K.C. & Brohlin, G. (2004). Executive functions in children aged 6 to 13: A dimensional and developmental study. *Developmental Neuropsychology*, (26)2, 571-593.
- Brown, S. A., Blanchard, J. J., & Horan, W. P. (1998). Social anhedonia and schizotypy: The role of stress, coping, and social support, *Paper presented at the thirteenth Annual Meeting of the Society for Research in Psychopathology*. Boston, MA.
- Cannon, M., Caspi, A., Moffitt, T. E., Harrington, H., Taylor, A., Murray, R. M., et al. (2002). Evidence for early-childhood, pan-developmental impairment specific to schizophreniform disorder: Results from a longitudinal birth cohort. *Arch Gen Psychiatry*, 59(5), 449-456.
- Cardno, A. G., Marshall, E. J., Coid, B., Macdonald, A. M., Ribchester, T. R., Davies, N. J., et al. (1999). Heritability estimates for psychotic disorders: The maudslay twin psychosis series. *Arch Gen Psychiatry*, 56(2), 162-168.
- Chapman, L. J., & Chapman, J. P. (1976). The infrequency scale: Unpublished test.
- Chapman, L. J., & Chapman, J. P. (1985). Psychosis proneness. In M. Alpert (Ed.), *Controversies in schizophrenia*. New York: Guilford.
- Chapman, L. J., Chapman, J. P., Kwapil, T. R., Eckblad, M., & Zinser, M. C. (1994). Putatively psychosis-prone subjects 10 years later. *J Abnorm Psychol*, 103(2), 171-183.
- Chapman, L. J., Chapman, J. P., Numbers, J. S., Edell, W. S., Carpenter, B. N., & Beckfield, D. (1984). Impulsive nonconformity as a trait contributing to the prediction of psychotic-like and schizotypal symptoms. *J Nerv Ment Dis*, 172(11), 681-691.
- Chapman, L. J., Chapman, J. P., & Raulin, M. L. (1976). Scales for physical and social anhedonia. *J Abnorm Psychol*, 85(4), 374-382.
- Chapman, L. J., Chapman, J. P., & Raulin, M. L. (1978). Body-image aberration in schizophrenia. *J Abnorm Psychol*, 87(4), 399-407.

- Chmielewski, P. M., Fernandes, L. O., Yee, C. M., & Miller, G. A. (1995). Ethnicity and gender in scales of psychosis proneness and mood disorders. *J Abnorm Psychol*, 104(3), 464-470.
- Cornblatt, B., & Obuchowski, M. (1997). Update of high-risk research: 1987-1997. *International Review of Psychiatry*, 9, 437-447.
- Cornblatt, B., Obuchowski, M., Roberts, S., Pollack, S., & Erlenmeyer-Kimling, L. (1999). Cognitive and behavioral precursors of schizophrenia. *Dev Psychopathol*, 11(3), 487-508.
- Cowen, E.L., Work, W.C., Wyman, P.A., & Jarrell, D.D. (1994) Relationship between retrospective reports of developmental milestones and school adjustment at ages 10 to 12 years. *Journal of the American Academy of Child and Adolescent Psychiatry*, 33(3), 400-406.
- Eckblad, M., & Chapman, L. J. (1983). Magical ideation as an indicator of schizotypy. *J Consult Clin Psychol*, 51(2), 215-225.
- Eckblad, M. L., Chapman, L. J., Chapman, J. P., & Mishlove, M. (1982). The revised social anhedonia scale: Unpublished test, University of Wisconsin at Madison.
- Erlenmeyer-Kimling, L., Rock, D., Squires-Wheeler, E., Roberts, S., & Yang, J. (1991). Early life precursors of psychiatric outcomes in adulthood in subjects at risk for schizophrenia or affective disorders. *Psychiatry Res*, 39(3), 239-256.
- Faraone, S. V., & Tsuang, M. T. (1985). Quantitative models of the genetic transmission of schizophrenia. *Psychol Bull*, 98(1), 41-66.
- Fish, B. (1987). Infant predictors of the longitudinal course of schizophrenic development. *Schizophr Bull*, 13(3), 395-409.
- Fish, B., Marcus, J., Hans, S. L., Auerbach, J. G., & Perdue, S. (1992). Infants at risk for schizophrenia: Sequelae of a genetic neurointegrative defect. A review and replication analysis of pandyismaturation in the jerusalem infant development study. *Arch Gen Psychiatry*, 49(3), 221-235.
- Fowles, D. C. (1992). Schizophrenia: Diathesis-stress revisited. *Annu Rev Psychol*, 43, 303-336.
- Gottesman, II, & Bertelsen, A. (1989). Confirming unexpressed genotypes for schizophrenia. Risks in the offspring of fischer's danish identical and fraternal discordant twins. *Arch Gen Psychiatry*, 46(10), 867-872.

- Gottesman, II, & Erlenmeyer-Kimling, L. (2001). Family and twin strategies as a head start in defining prodromes and endophenotypes for hypothetical early-interventions in schizophrenia. *Schizophr Res*, 51(1), 93-102.
- Gottesman, I. (1991). *Schizophrenia genesis: The origins of madness*. New York: Freeman.
- Hans, S. L., Marcus, J., Henson, L., Auerbach, J. G., & Mirsky, A. F. (1992). Interpersonal behavior of children at risk for schizophrenia. *Psychiatry*, 55(4), 314-335.
- Henriksson, K. M., & McNeil, T. F. (2004). Health and development in the first 4 years of life in offspring of women with schizophrenia and affective psychoses: Well-baby clinic information. *Schizophr Res*, 70(1), 39-48.
- Henry, B., Moffitt, T. E., Caspi, A., Langley, J., & Silva, P. A. (1994). On the "remembrance of things past": A longitudinal evaluation of the retrospective method. *Psychological Assessment*, 6(2), 92-101.
- Hollis, C., & Taylor, E. (1997). Schizophrenia: A critique from the developmental psychopathology perspective. In M. S. Keshavan & R. M. Murray (Eds.), *Neurodevelopment and adult psychopathology*. New York, NY: Cambridge University Press.
- Hollister, J. M., Machon, R. A., & Mednick, S. A. (1995). A multidisciplinary approach to the neurodevelopment of schizophrenia. In S. A. Mednick & J. M. Hollister (Eds.), *Neural development and schizophrenia* (pp. 1-11). New York: Plenum Press.
- Hops, H., & Seeley, J. R. (1992). Parent participation in studies of family interaction: Methodological and substantive consideration. *Behavioral Assessment*, 14(3-4), 229-243.
- Horan, W. P., Blanchard, J. J., Gangestad, S. W., & Kwapil, T. R. (2004). The psychometric detection of schizotypy: Do putative schizotypy indicators identify the same latent class? *J Abnorm Psychol*, 113(3), 339-357.
- Ingraham, L. J., Kugelmass, S., Frenkel, E., Nathan, M., & Mirsky, A. F. (1995). Twenty-five-year followup of the Israeli high-risk study: Current and lifetime psychopathology. *Schizophr Bull*, 21(2), 183-192.
- Isihanni, M., Jones, P. B., Moilanen, K., Rantakallio, P., Veijola, J., Oja, H., et al. (2001). Early developmental milestones in adult schizophrenia and other psychoses. A 31-year follow-up of the northern Finland 1966 birth cohort. *Schizophr Res*, 52(1-2), 1-19.

- Jablensky, A. (2000). Epidemiology of schizophrenia: The global burden of disease and disability. *Eur Arch Psychiatry Clin Neurosci*, 250(6), 274-285.
- Jones, P., & Done, D. J. (1997). From birth to onset: A developmental perspective of schizophrenia in two national birth cohorts. In M. S. Keshavan & R. M. Murray (Eds.), *Neurodevelopment and adult psychopathology*. New York, NY: Cambridge University Press.
- Jones, P., Rodgers, B., Murray, R., & Marmot, M. (1994). Child development risk factors for adult schizophrenia in the british 1946 birth cohort. *Lancet*, 344(8934), 1398-1402.
- Jones, P. B., Murray, R. M., & Rodgers, B. (1995). Childhood risk factors for schizophrenia in a general population birth cohort at age 43 years. In S. A. Mednick (Ed.), *Neural development in schizophrenia: Theory and practice*. New York: Plenum Press.
- Kelley, M. P., & Coursey, R. D. (1992). Lateral preference and neuropsychological correlates of schizotypy. *Psychiatry Res*, 41(2), 115-135.
- Kendler, K. S., & Diehl, S. R. (1993). The genetics of schizophrenia: A current, genetic-epidemiologic perspective. *Schizophr Bull*, 19(2), 261-285.
- Kraepelin, E. (1919). *Dementia praecox and paraphrenia* (R. M. Barclay, Trans.). Huntinton, NY: Robert E. Krieger Publishing Company.
- Kwapil, T. R. (1998). Social anhedonia as a predictor of the development of schizophrenia-spectrum disorders. *J Abnorm Psychol*, 107(4), 558-565.
- Lengua, L. J., Sadowski, C. A., Friedrich, W. N., & Fisher, J. (2001). Rationally and empirically derived dimensions of children's symptomatology: Expert ratings and confirmatory factor analyses of the cbcl. *J Consult Clin Psychol*, 69(4), 683-698.
- Lenzenweger, M. F. (1994). Psychometric high-risk paradigm, perceptual aberrations, and schizotypy: An update. *Schizophr Bull*, 20(1), 121-135.
- Loeber, R., & Farrington, D. P. (1994). Problems and solutions in longitudinal and experimental treatment studies of child psychopathology and delinquency. *J Consult Clin Psychol*, 62(5), 887-900.
- Loeber, R., Green, S. M., & Lahey, B. B. (1990). Mental health professionals' perception of the utility of children, mothers, and teachers as informants on childhood psychopathology. *Journal of Clinical Child Psychology*, 19, 136-143.

- Loeber, R., Green, S. M., Lahey, B. B., & Stouthamer-Loeber, M. (1991). Differences and similarities between children, mothers, and teachers as informants on disruptive child behavior. *J Abnorm Child Psychol*, 19(1), 75-95.
- Loranger, A. W., Andreoli, A., Berger, P., Buchheim, P., Channabasavanna, S.M., Coid, B., Dahl, A., Diekstra, R.F.W., Ferguson, B., Jaccobsberg, L.B., Janca A., Mombour, W., Pull, C., Ono, Y., Reigier, D.A., Santorius, N., Sumba, R.O. (1995). The international personality disorder examination (ipde) manual: World Health Organization, New York.
- Loranger, A. W., Sartorius, N., Andreoli, A., Berger, P., Buchheim, P., Channabasavanna, S. M., et al. (1994). The international personality disorder examination. The world health organization/alcohol, drug abuse, and mental health administration international pilot study of personality disorders. *Arch Gen Psychiatry*, 51(3), 215-224.
- Marcus, J., Auerbach, J., Wilkinson, L., & Burack, C. M. (1981). Infants at risk for schizophrenia. The jerusalem infant development study. *Arch Gen Psychiatry*, 38(6), 703-713.
- McDonald, C., & Murray, R. M. (2000). Early and late environmental risk factors for schizophrenia. *Brain Res Brain Res Rev*, 31(2-3), 130-137.
- Mednick, S. A., & Hutchings, B. (1978). Genetic and psychophysiological factors in asocial behavior. *J Am Acad Child Psychiatry*, 17(2), 209-223.
- Meehl, P. E. (1962). Schizotaxia, schizotypy, schizophrenia. *American Psychologist*, 17, 827-838.
- Meehl, P. E. (1990). Toward an integrated theory of schizotaxia, schizotypy, and schizophrenia. *Journal of Personality Disorders*, 4, 1-99.
- Miller, P. M., Byrne, M., Hodges, A., Lawrie, S. M., & Johnstone, E. C. (2002). Childhood behaviour, psychotic symptoms and psychosis onset in young people at high risk of schizophrenia: Early findings from the edinburgh high risk study. *Psychol Med*, 32(1), 173-179.
- Mishlove, M., & Chapman, L. J. (1985). Social anhedonia in the prediction of psychosis proneness. *J Abnorm Psychol*, 94(3), 384-396.
- Nagler, S., & Mirsky, A. F. (1985). Introduction: The israeli high-risk study. *Schizophr Bull*, 11(1), 19-29.
- Neumann, C., & Walker, E. F. (1996). Childhood neuromotor functions, behavior problems and psychopathology. In T. Ollendick & R. Prinz (Eds.), *Advances in clinical child psychology*. New York: Plenum.

- Neumann, C. S., Grimes, K., Walker, E. F., & Baum, K. (1995). Developmental pathways to schizophrenia: Behavioral subtypes. *J Abnorm Psychol*, 104(4), 558-566.
- Newman, D. L., Moffitt, T. E., Caspi, A., & Silva, P. A. (1998). Comorbid mental disorders: Implications for treatment and sample selection. *J Abnorm Psychol*, 107(2), 305-311.
- Niemi, L. T., Suvisaari, J. M., Tuulio-Henriksson, A., & Lonnqvist, J. K. (2003). Childhood developmental abnormalities in schizophrenia: Evidence from high-risk studies. *Schizophr Res*, 60(2-3), 239-258.
- Rado, S. (1956). *Psychoanalysis of behavior*. New York, NY: Grune & Stratton.
- Robins, L. N., Helzer, J. E., Weissman, M. M., Orvaschel, H., Gruenberg, E., Burke, J. D., Jr., et al. (1984). Lifetime prevalence of specific psychiatric disorders in three sites. *Arch Gen Psychiatry*, 41(10), 949-958.
- Rossi, A., Pollice, R., Daneluzzo, E., Marinangeli, M. G., & Stratta, P. (2000). Behavioral neurodevelopment abnormalities and schizophrenic disorder: A retrospective evaluation with the childhood behavior checklist (cbcl). *Schizophr Res*, 44(2), 121-128.
- Rossi, A., Pollice, R., Stratta, P., Arduini, L., Marinangeli, M. G., & Daneluzzo, E. (2002). Wisconsin card-sorting test performance does not discriminate different patterns of premorbid behavioral abnormalities in schizophrenic patients. *Psychiatry Clin Neurosci*, 56(4), 403-407.
- Rutter, M. (1984). Psychopathology and development: I. Childhood antecedents of adult psychiatric disorder. *Aust N Z J Psychiatry*, 18(3), 225-234.
- Rutter, M. (1998). Routes from research to clinical practice in child psychiatry: Retrospect and prospect. *J Child Psychol Psychiatry*, 39(6), 805-816.
- Sourander, A., Helstela, L., & Helenius, H. (1999). Parent-adolescent agreement on emotional and behavioral problems. *Soc Psychiatry Psychiatr Epidemiol*, 34(12), 657-663.
- Tarrant, C. J., & Jones, P. B. (1999). Precursors to schizophrenia: Do biological markers have specificity? *Can J Psychiatry*, 44(4), 335-349.
- Walker, E. F., & Baum, K. (1998). Developmental changes in the behavioral expression of vulnerability for schizophrenia. In M. Lenzenweger & R. Dworkin (Eds.), *Experimental psychopathology and the pathogenesis of*

- schizophrenia*. (pp. 469-492). Washington, DC: American Psychological Association.
- Walker, E. F., & Diforio, D. (1997). Schizophrenia: A neural diathesis-stress model. *Psychol Rev*, 104(4), 667-685.
- Walker, E. F., Diforio, D., & Baum, K. (1999). Developmental neuropathology and the precursors of schizophrenia. *Acta Psychiatr Scand Suppl*, 395, 12-19.
- Walker, E. F., Savoie, T., & Davis, D. (1994). Neuromotor precursors of schizophrenia. *Schizophr Bull*, 20(3), 441-451.
- Waller, N. G., & Meehl, P. E. (1998). *Multivariate taxometric procedures: Distinguishing types from continua*. Newbury Park, CA: Sage.
- Weinberger, D. R. (1987). Implications of normal brain development for the pathogenesis of schizophrenia. *Arch Gen Psychiatry*, 44(7), 660-669.
- Youngstrom, E., Loeber, R., & Stouthamer-Loeber, M. (2000). Patterns and correlates of agreement between parent, teacher, and male adolescent ratings of externalizing and internalizing problems. *J Consult Clin Psychol*, 68(6), 1038-1050.